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# REVIEW
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SERIES A.

VOL. 28. 1940.

RAMAKRISHNA AYYAR (T. V.). **The Rice Mealy Bug in South India.**—*J. Mysore agric. exp. Un.* **17** no. 4 pp. 179–188, 11 refs. Bangalore, 1939.

The condition of rice known as soorai disease and caused by the Coccid, *Ripersia oryzae*, Green, is described [*cf. R.A.E.*, A **25** 748], and its history and distribution in India are briefly reviewed. It has been recorded chiefly from the Madras Presidency. It is pointed out that references in the literature to the Coccid associated with this condition of rice as *Trionymus* (*Pseudococcus*) *sacchari*, Ckll., or *R. sacchari*, Green, should be considered to refer to *R. oryzae*. All stages of this Coccid are found on the plant at the same time. Reproduction is thought to be principally parthenogenetic, though males occur. Females lay 10–300 eggs during a period of 5–6 days. A list of alternative food-plants is given. Natural enemies include Chalcidoid parasites of the eggs and later stages, the Drosophilid, *Gitonides perspicax*, Knab, the Agromyzid, *Leucopis luteicornis*, Malloch, and a Coccinellid (*Scymnus* sp.), but they do not appear of importance in control. Ants act as distribution agents. Severe drought, bad drainage and poor soil increase infestation, which is reduced by the early destruction of all grasses on which breeding occurs, the elimination of unhealthy seedlings before transplanting, and adequate manuring.

PRUTHI (H. S.). **Report of the Imperial Entomologist.**—*Sci. Rep. agric. Res. Inst. New Delhi 1937–38* pp. 113–128. Delhi, 1939.

Studies were carried out in India on the fecundity and development of the spotted bollworm of cotton, *Earias fabia*, Stoll., and its parasites, *Microbracon lefroyi*, D. & G., and *Goryphus* (*Melcha*) *nursei*, Cam., at constant temperatures and saturation deficiencies. The fecundity of *E. fabia* was increased by high temperature during the development period, and by low saturation deficiency during adult life. The egg, larval and pupal stages lasted 11–12, 35 and 32–33 days at 16°C. [60·8°F.] and 7, 20 and 17–18 days at 20°C. [68°F.]. Development was quickest at a saturation deficiency of 3 mm. At 100 per cent.

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relative humidity, which is the most favourable for *Microbracon*, the maximum number of eggs per female and the average periods required for development from egg to adult in days were 39 and 27 at 16°C., 32 and 19 at 20°C., and 58 and 11 at 25°C. [77°F.]. Females of *Goryphus* oviposit for preference on prepupae. At 16°C., the number of eggs laid varied from 6 to 23, but usually at least 56 and sometimes 150 hosts were paralysed. In a saturated atmosphere, the life-cycle at 16, 20 and 24°C. [75·2°F.] required about 40, 26 and 19 days.

During extensive experiments on the transmission of tobacco leaf-curl in northern India [*R.A.E.*, A **26** 242], it was shown that *Bemisia gossypiperda*, Misra & Lamba, is an important vector of the five types of tobacco leaf-curl virus. Sunn-hemp [*Crotalaria juncea*] is an important alternate host of the viruses A and X, the two viruses causing different symptoms in it. *B. gossypiperda* can transmit both types of disease from sunn-hemp to tobacco, and, less effectively, back from tobacco to sunn-hemp. In northern Bihar, natural infection of sunn-hemp seems to occur in July, but leaf-curl does not appear in tobacco before the middle of September. *Ageratum conyzoides* is also an important alternate host, especially of the D type, and the Aleurodid can transmit the disease easily to this weed from tobacco and sunn-hemp and from it to tobacco. It cannot transmit it so easily from *A. conyzoides* to sunn-hemp. The alternate hosts, if any, for the B and C types of virus remain unknown. Tobacco is most susceptible when it is about 8 weeks old and between mid-September and mid-November or in February, and sunn-hemp when it is 2–3 months old, during July and August. *B. gossypiperda* can acquire the virus after 5–6 hours' feeding ; shorter periods were not tested. It was observed breeding freely on a number of other plants, some of which show symptoms of leaf-curl, which may be closely allied to, if not identical with, leaf-curl of tobacco.

*Dacus* (*Chaetodacus*) *ferrugineus*, F., was found to be active in the Peshawar district of the North-West Frontier Province from July to the end of September, and to attack 50–70 per cent. of the fruits of peach and pear. In Kohat District, 50–80 per cent. of loquat [*Eriobotrya japonica*], apricot, guava and fig crops are attacked in succession from April to November, while peach, pear and persimmon are attacked to the same extent in Parachinar from mid-August to October. At Kohat, the larval and pupal stages lasted 7–8 and 6–7 days, respectively, in September. Of various baits tested, clensel and pollard were the most effective ; citronella attracted more flies, but they were all males. A sodium fluosilicate bait-spray was ineffective. Larvae of *Eurytoma samsonovi*, Vass., are found in the kernels of apricots from May to the middle of February [*cf.* **27** 503] in the North-West Frontier Province. Infested fruits readily fall from the trees. Pupation takes place in the seeds, and the adults bore their way out. The eggs are apparently laid in the unripe fruit.

Eggs of the Acridid, *Poecilocerus pictus*, F., which feeds on various crops at Delhi [*cf.* **27** 577], are usually laid in masses of about 100 in the soil, from June to August. A few hoppers hatch after 7–8 weeks and overwinter, but most of them do not hatch until the following spring. The hoppers that hatch in the spring undergo 5–7 moults and take 7–9 weeks to become adult, each instar lasting 1–2 weeks. The hoppers that overwinter undergo one or two extra moults before becoming adult in the following spring. Development does not appear to take place below 24°C., but it is fairly rapid between 32 and 35°C.

[89·6 and 95°F.] A spray of sodium arsenite (2 lb. per 100 gals. water) killed 33 per cent. of the hoppers on brinjal [*Solanum melongena*] on the day of application, and the remainder within the next three days. The most important parasite of *Lixus truncatulus*, F., a minor pest of *Amarantus* throughout the plains of India [**25** 530], was the Eulophid, *Pareuderus torymoides*, Ferrière, which attacked 31 per cent. of the eggs at Pusa. In laboratory studies on the bionomics of *Leucopis griseola*, Fall., the larvae of which are predacious on various Aphids, the egg and larval stages lasted 4–7 and 16–21 days, and the pupal stage 29–49 days during November-January.

The egg, larval and pupal stages of *Corcyra cephalonica*, Stn., on stored wheat usually lasted 3–6, 25–40 and 9–12 days, but the larval stage was sometimes as long as 96 days in September and October, and the winter was passed in this stage. Relative humidities of 36 and 56 per cent. seemed to be very unfavourable to *Calandra oryzae*, L., at 20°C.; 68 per cent. was more favourable. At 87 per cent., the best relative humidity, the period of development from egg to adult was 6–7 weeks, of which the larval and pupal periods occupied 4–5 weeks and 11–16 days, respectively. At 90–92 per cent. relative humidity, development was very slow at 16°C., and no eggs were laid at 13°C. [55·4°F.]. A poison-bait containing sodium fluosilicate proved highly effective against *Gryllulus* (*Gryllus*) *domesticus*, L., damaging artificial silk in a textile mill in the central Punjab. Setts of sugar-cane immersed for 30–60 seconds immediately before planting in a suspension of 5 per cent. of lead arsenate and cold water or one of 2 per cent. Paris green mixed with 4 per cent. lime remained free from termite attack, while others immersed in 5 per cent. sodium fluosilicate began to show signs of attack after a month and those having the ends smeared with coal tar and the controls were damaged after three weeks. Dusting young cucurbit crops 2 or 3 times at an interval of about a week with a mixture of Paris green and wood ash (1 : 80 by weight) was very effective against *Raphidopalpa* (*Aulacophora*) *foveicollis*, Lucas.

Lists are given of insects found infesting crops, mostly in Delhi, and their natural enemies.

Isaac (P. V.). **Report of the Second Entomologist (Dipterist) in Charge of Scheme for Research on Insect Pests of Sugarcane.**—*Sci. Rep. agric. Res. Inst. New Delhi 1937–38* pp. 129–131. Delhi, 1939.

At New Delhi, sugar-cane was attacked by the stem-borers, *Raphimetopus ablutella*, Zell., and *Diatraea* (*Argyria*) *sticticraspis*, Hmps., and the root-borer, *Emmalocera depressella*, Swinh., when 2–4 months old, and later by the top-borer, *Scirpophaga nivella*, F. [*R.A.E.*, A **27** 558]. Results are given of observations on the incidence of the last three and of termites at Karnal on four varieties of cane during the season and at harvest. Termites and various moth-borers, including *Chilo zonellus*, Swinh., and *E. depressella* caused damage at Pusa throughout the year, while *Pyrilla*, *Proutista* (*Assamia*) *moesta*, Westw., *Trionymus sacchari*, Ckll., and *Aleurolobus barodensis*, Mask., were common during November. Work begun at Coimbatore indicated that a strong midrib gives resistance to *S. nivella* [*cf.* **27** 575].

In an experiment at Cuttack on the introduction of *Trichogramma minutum*, Riley, for the control of *D. sticticraspis*, significantly less dead-hearts were produced in a plot colonised in February and March

1937 than in the control, and counts of larvae in the stalks at harvest gave some indication that *Trichogramma* was effective in reducing the population of this borer.

China (W. E.). **On the Generic Nomenclature of certain Homoptera with a Note on the Status of Family Names.**—*Ann. Mag. nat. Hist.* (11) **4** no. 24 pp. 582–587. London, 1939.

In the course of this paper, the author points out that the generic name *Cicadella*, Latr. (type *Cicada viridis*, L.) is preoccupied by *Cicadella*, Duméril (type *Cicada vittata*, L.). The next available name for *Cicadella*, Latr., is *Amblycephalus*, Curt., which has the same type. *Eupteryx*, Curt. (type *atropunctata*, Goeze) is considered congeneric with *Cicadella*, Duméril.

Turnbull (J.). **Commercial Fruit Tree Spraying. Methods and Costs.** —*Bull. Minist. Agric.* no. 5 (4th edn.) v+76 pp., 8 pls., 25 refs. London, H.M.S.O., 1939. Price 1*s.* 6*d.*

In this bulletin, which is the fourth edition of one previously noticed [*R.A.E.*, A **15** 363] and deals comprehensively with the economic aspect of commercial fruit-tree spraying in England, the necessity is stressed for using adequate equipment to enable the whole operation to be completed within the brief time limit, imposed by the stage of growth of the tree and often still further reduced by unfavourable weather conditions, within which applications should be made to ensure satisfactory results. Failure in spraying is often due to this period being exceeded. Improvements in spraying apparatus and in methods of working, put forward as the result of trials in recent years in order to facilitate rapid spraying, are described in the section on methods of spraying, which also contains recommendations for reducing the proportion of time taken up by subsidiary operations and by delays caused by weather conditions and mechanical defects, which is frequently greater than that occupied in the actual application. The most suitable system of spraying and size of plant to adopt can be determined when the amount of spray that must be applied daily to provide, within the given time, the quantity per acre needed for successful control is known; a discussion of the general factors on which this depends is followed by notes on various insecticides and fungicides, with recommendations for reducing the amount of spray damage caused by each. The sequence of sprays advised for commonly grown stone and soft fruits is shown in a table.

Information on the field performance, price and cost of maintenance of different types of apparatus, including small-scale equipment, and on water supplies is given in the section dealing with machinery and plant. A section on the total cost of spraying shows estimates for the application, under optimum conditions, of the programmes in general use, and brief notes on dusting and atomisation are appended.

Kunike (G.). **Neuere Ergebnisse über die Eiablage und Generationsfolge der *Anthrenus*-Arten. Vorläufige Mitteilung.** [Recent Results on the Oviposition and Sequence of Generations in the Species of *Anthrenus*. Preliminary Communication.]—*Anz. Schädlingsk.* **15** pt. 7 pp. 80–84, 7 figs. Berlin, 1939.

Carpet beetles (*Anthrenus* spp.) have occurred with increasing frequency in Germany of recent years and are now economically as

important as the clothes moth [*Tineola biselliella*, Humm.]. The author records the results of investigations on their life-history carried out in the laboratory since 1937. Some of the information has already been noticed [*R.A.E.*, A **27** 47]. In Germany, *A. scrophulariae*, L., is the chief pest of woollen goods and furs, while *A. verbasci*, L., is the most common in dwellings and warehouses. Larvae of *A. pimpinellae*, F., have been found in dwellings occasionally, and those of *A. museorum*, L., in museum collections, while *A. fuscus*, Ol., has not yet been observed causing economic injury.

The development cycle of all the species usually requires at least a year. The larvae pupate in the last larval skin, in which the young adult remains for some days after emerging from the pupal envelope. They are able to complete their development on dried insects, but also feed on keratin, hair, feathers, horn and powdered meat, blood and bones. When the larvae were placed on woollen cloth on which there were dead insects, *A. scrophulariae* and *A. pimpinellae* preferred the wool, *A. verbasci* ate more insects than wool, and *A. museorum* and *A. fuscus* ate very little wool. When the temperature rises to about 20°C. [68°F.] in mid-May, the adults are found in the open, especially in sunny weather, feeding on pollen and nectar in the blossoms of *Spiraea*, *Sorbus*, *Crataegus* and umbelliferous plants. Those of *A. scrophulariae* and *A. pimpinellae* are the first to appear in abundance, the former being about 3 times as numerous as the latter. *A. verbasci* is not very abundant in mid-May, and *A. museorum* and *A. fuscus* usually appear later.

The adults of *A. scrophulariae* are common in May and early June, and become increasingly rare in July and August. Captive females oviposited on woollen cloth. Larvae from eggs laid in May began to pupate in the second half of August, and about 75 per cent. of them had pupated by October. The pupal stage lasted 18–19 days at 18–20°C. [64·4–68°F.], 12–14 at 22–26°C. [71·6–78·8°F.] and 10–11 at 27°C. [80·6°F.]. As a rule, the adults overwinter in the larval skin, but at high room temperatures, such as 24–25°C. [75·2–77°F.] in autumn, they emerged after 15–20 days, though they did not pair until the spring. In houses, the adults seek cool places in which to overwinter. Most of those kept at 20°C. died before spring without ovipositing. The remaining 25 per cent. of the larvae developed slowly in spite of abundant food, and hibernated. They resumed feeding when the days began to lengthen towards the end of winter. A few pupated in spring and gave rise to adults that emerged and oviposited at about the same time as those that had overwintered, but the majority pupated in late summer and hibernated as adults, thus having a two-year life-cycle. The adults that emerged in spring lived for 2–4 weeks.

*A. pimpinellae* has a comparatively short larval development. The egg stage lasted 15 days at 22°C. and 8 at 26°C. Nearly all the larvae from eggs laid in May or June pupated in the autumn, and the resulting adults overwintered, some still in the larval skin. In constantly warm surroundings, they died during the winter. About 1 per cent. of the larvae develop slowly, hibernate, resume feeding about the end of January, and pupate in spring, but the resulting adults appear on blossoms at the same time as those that have overwintered.

Though adults of *A. verbasci* are common on blossoms in the warm season, they can reproduce without feeding, and the species has become completely adapted to life indoors; it has been maintained for

9 years in the laboratory. Breeding experiments with adults kept without food showed that the pre-oviposition period was 4 days for females that paired on the day of emergence and 2–3 days for those that paired 3–4 days later. All the eggs were laid within 3–4 days, the total number being 13–44, with an average of about 30; they hatched in 18–20 days at 20–22°C., 15 at 23–24°C. [73·4–75·2°F.], and 13 at 26°C. In warm rooms, the larvae that hatched from eggs deposited in May or June fed throughout the winter, and some gave rise to adults that emerged and oviposited in January and February. The resultant larvae developed in 5–6 months and pupated in July or August, and the adults from them gave rise to larvae that pupated in spring. The beetle can therefore produce two generations in 13 or 14 months. Normally, however, the life-cycle lasts a year, and larvae from eggs laid in May or June do not pupate until the spring; the resulting adults are present on blossoms from May onwards. As adult emergence is prolonged up to September, total development takes 7–14 months. *A. verbasci* hibernates in the larval stage only. The pupal stage lasted 14–16 days at 16–18°C. [60·8–64·4°F.], 12–13 at 20–22°C., 9–11 at 22–26°C., and 8–9 on a table exposed to sunshine, where the temperatures rose to 30°C. [86°F.] for some hours daily. The adults remained in the larval skin for 7–8 days at 16–18°C., 5–6 days at 20–22°C., and 4–5 days on the table. At room temperature, unfed males given opportunities for pairing, lived for an average of 13–14 days, with a maximum of 24. The longevity of paired females averaged 13–17 days with extremes of 7–41.

The development of *A. museorum*, which is not common in Germany, closely resembles that of *A. verbasci*. The adults are not present on blossoms until about the end of June. The pre-oviposition period lasted 4 days for females that paired on the day of emergence, and 3 days for older ones. The eggs were deposited during the 3 days after pairing, and averaged 21–23 per female. The larvae hatched in 15–17 days at 20–22°C. and fed throughout the summer; they did not feed during the winter, even in heated rooms, but resumed activity in January or February. Pupation began in February, so that development normally takes about a year, varying between 7 and 14 months. Some of the larvae were full-fed by the autumn; these pupated in February. Pupation may occur up to July. The pupal period lasted 9–10 days at 20–22°C., and the adults remained in the larval skin for 4–5 days. If pairing was possible, the males lived for 10–14 days and the females for 12–18. *A. museorum* oviposits without feeding and hibernates only in the larval stage.

Adults of *A. fuscus*, which is rare, appear on blossoms at the same time as those of *A. museorum*. The larvae overwinter and resume feeding in the spring.

**Plantesygdomme i Danmark 1938. Plant Diseases and Pests in Denmark in 1938.**—*Tidsskr. Planteavl* **44** repr. 53 pp., 5 figs.; also as *Overs. St. Plantepat. Forsøg* no. 55. Copenhagen, 1939. (With a Summary in English.)

This report contains a section (pp. 37–49) by P. Bovien, in which he surveys the principal pests of cultivated plants in Denmark in 1938 as in previous years. *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., is still spreading on apple [*cf. R.A.E.*, A **27** 117], and in one locality

attacked *Cotoneaster horizontalis*. Infestation of apple by *Cydia* (*Carpocapsa*) *pomonella*, L., was variable, and was satisfactorily controlled by a spray of lead arsenate. Damage was considerable in one district where spraying was omitted. *Paratetranychus pilosus*, C. & F., was common on apple in August-September, and in one locality hindered the growth of the trees and reduced the size of the fruits. *Caliroa* (*Eriocampoides*) *limacina*, Retz., skeletonised the leaves of cherry and pear from July to mid-October, and was particularly numerous in September. Adults of *Contarinia pyrivora*, Ril., emerged in one area on 17th April and were numerous at the end of the month. Infestation of pear by this Cecidomyiid was sporadic. The measures adopted against the adults included four applications of a spray of nicotine [*cf.* **25** 766] and dusting the trees and the soil with derris. *Cydia* (*Laspeyresia*) *funebrana*, Treitschke, caused considerable injury to plum.

Adults of *Melolontha melolontha*, L. (*vulgaris*, F.) emerged at the end of April and were numerous in mid-May. The local distribution of the swarms is described, and it is considered that the beetles were less numerous than they had been in 1934. Adults of *M. hippocastani*, F., were also observed. This Melolonthid apparently has both a four-year and a five-year life-cycle in the area concerned. Young larvae of both species were scarce in the spring, probably owing to cold weather during the flight period of the adults, but larvae in the third year of development caused considerable damage in some districts.

Other injurious insects not mentioned in recent reports include *Macrosiphum avenae*, F. (*granarium*, Kby.) on oats and wheat, *Anomala* (*Phyllopertha*) *horticola*, L., the larvae of which caused much damage to rye in October, *Sitona lineata*, L., on clover, and *Byturus tomentosus*, F., on raspberry.

NOTINI (G.). **Klädesmalen.** [The Clothes' Moth.]—*Medd. St. Växtskyddsanst.* no. 28, 32 pp., 17 figs., 33 refs. Stockholm, 1939.

These investigations on the life-history and control of the clothes' moth, *Tineola biselliella*, Humm., were carried out in the laboratory in Sweden between 1934 and 1939. Descriptions are given of all stages of the moth, of the damage caused by the larvae, and of observations on oviposition and larval development. Females oviposited indiscriminately on various furs and skins, but the larvae showed preference for fur of certain kinds and woollen materials, on which they developed more rapidly than on others and gave rise to females that deposited more eggs. The optimum for larval development was 25°C. [77°F.] combined with high humidity, at which it lasted 49 days for some individuals but 60–75 for the majority. At 18–20°C. [64·4-68°F.] and 80 per cent. relative humidity, the egg stage lasted 6–7 days, and at 25°C., room temperature and 16°C. [60·8°F.] the pupal stage was completed in 8, 10–12 and 22 days, respectively. Larvae that give rise to males require less food than those that give rise to females, many of which do not survive partial starvation, so that under unfavourable conditions of nourishment, males predominate in a population.

It is estimated that in houses in Sweden, in which the temperature in winter is usually maintained at about 18°C. and in summer often exceeds 25°C., the moth produces four generations a year, but in

unwarmed parts of buildings only one. Eggs and larvae do not survive temperatures below 0°C. [32°F.] and −8·5°C. [16·7°F.], respectively, so that storage at the lower temperature controls infestation.

Experiments on the effect of paradichlorobenzene, in which young larvae in tubes closed with felt of varying thicknesses were exposed in an air-tight chamber at 20°C. for periods varying from 3 to 7 days, showed that even when it was applied at a rate equivalent to 1 oz. per 10 cu. ft., the percentage mortality did not exceed 40, although in open Petri dishes 95 per cent. mortality of older larvae was given by exposure to $\frac{3}{4}$ oz. for 6 days. These rates of application are much higher than could conveniently be used in practice, so that, although paradichlorobenzene exercised some repellent effect on larvae, its value for control appears to have been exaggerated. Some proprietary contact insecticides gave satisfactory control when sprayed on larvae on woollen cloth, but it is considered that they would be of little practical use, as the larvae are generally well hidden and thus protected from a spray. The best results were given by a proprietary spray containing trichlorethylene, paradichlorobenzene, pyrethrum extract and a small percentage of mineral oil, which acted both as a contact insecticide and a fumigant.

Parasites reared from the larvae comprised *Apanteles carpatus*, Say, *Hemiteles bicolorinus*, Grav., and *H. cingulator*, Grav., while *Pediculoides ventricosus*, Newp., attacked all the developmental stages of the moth. The author suggests that this mite should be liberated in premises in which furs and woollen goods are stored, though he recognises that some precautions would be necessary in view of the fact that it attacks man.

**Aperçu de la présence des insectes nuisibles et des maladies des arbres dans les forêts domaniales de Lettonie en 1937/38.** [*In Lettish.*]—Roy. 8vo, 17 pp. Riga, Dép. Fôrets, 1939. (With a Summary in French.)

In this report, a section by L. Brammanis contains notes on some 35 species of insect pests observed on trees in forests in various districts in Latvia during 1937–38. Outbreaks of *Ips typographus*, L., *I. chalcographus*, L., and *Polygraphus poligraphus*, L., occurred on spruce, as a result of damage to the trees by wind. The chief pests of pine were *Myelophilus* (*Blastophagus*) *piniperda*, L., and *M.* (*B.*) *minor*, Htg., which attacked trees infected with *Fomes annosus*, *Hylobius abietis*, L., with *Pissodes notatus*, F., which attacked trees infected with *Agaricus melleus*, and *Neodiprion* (*Lophyrus*) *sertifer*, Geoffr., an outbreak of which occurred over an area of about 33,350 acres in western districts. No appreciable injury was caused by larvae of *Melolontha hippocastani*, F., after the flight in 1936 [*cf. R.A.E.*, A **26** 722], probably because the areas damaged in 1935 had been thoroughly cultivated before reafforestation. The fact that the females avoid ovipositing in newly cultivated land was confirmed by the examination of samples of such soil, in which young larvae were only 20–25 per cent. as numerous as in uncultivated soil. *M. melolontha*, L. (*vulgaris*, F.) spread towards the west, and caused some injury in nurseries; a flight is to be expected in 1939.

The local distribution and frequency of occurrence of various pests and diseases are shown in tables.

CUMPSTON (D. M.). **Observations on the Bionomics and Morphology of seven Species of the Tribe Paropsini (Chrysomelidae).**—*Proc. Linn. Soc. N.S.W.* **64** pt. 3–4 pp. 353–366, 1 pl., 22 figs., 8 refs. Sydney, 1939.

Details are given of the morphology of the immature stages and the bionomics of five Chrysomelids of the genus *Paropsis* and two of allied genera, the larvae and adults of which feed on the leaves of *Eucalyptus* in Australia. The larvae were parasitised by unidentified Hymenoptera and Tachinids, and the Pteromalid, *Neopolycystus insectifurax*, Gir., and the Encyrtid, *Baeoanusia albifunicle*, Gir., were bred from the eggs of *P. reticulata*, Marsh.

MCKEOWN (K. C.). **A Note on the Synonymy of** *Leptops* **(Coleoptera : Curculionidae).**—*Proc. Linn. Soc. N.S.W.* **64** pt. 3–4 p. 408. Sydney, 1939.

The author points out that the name *Leptops*, used by Schoenherr for a genus of Australian weevils, is preoccupied in fish and that the next available name is *Baryopadus*, Pasc.

DE MEDELLA E SILVA (J. B.). **O gafanhoto** *Eutropidacris cristata* **(L.) no Norte de Minas.** [The Grasshopper, *E. cristata*, L., in the North of Minas Geraes.]—*Bol. Minist. Agric. (Brasil)* **27** no. 7–12 pp. 109–114, 5 figs. Rio de Janeiro, 1938. [Recd. 1939.]

*Eutropidacris cristata*, L., caused damage to mango, orange, cassava [*Manihot utilissima*], avocado [*Persea gratissima*], cotton, sugar-cane and rice in the north of the State of Minas Geraes, Brazil, in 1937. It occurred in large numbers without forming swarms, and no mass flights were observed. Hoppers were abundant in June, July and August, but adults only were observed later. Great mortality was caused by the torrential summer rains. Natural enemies included fowls and other birds. Spraying and dusting with arsenicals are recommended, as well as the use of a poison bait consisting of 100 lb. bran, 4 lb. white arsenic, 1·6 gals. molasses and 5·6 gals. water, to be distributed in June, July and August.

HAMBLETON (E. J.). **O percevejo** *Horcius nobilellus* **(Berg) como nova prága do algodoeiro em S. Paulo. Observações preliminares.** [The Bug, *H. nobilellus*, as a new Pest of Cotton in São Paulo.]—*Arq. Inst. biol.* **9** pp. 85–92, 3 pls. S. Paulo, 1938. (With a Summary in English.) [Recd. 1939.]

*Horcias nobilellus*, Berg, a Capsid not previously recorded from the State of São Paulo, Brazil, has been observed in a number of cotton fields there during recent years. A serious outbreak occurred in one district in the season of 1937–38, causing a crop loss estimated at 25 per cent. in one plantation. Investigations indicated that the Capsid feeds on many plants, but prefers Malvaceae, including *Sida cordifolia* and *S. rhombifolia*. Both nymphs and adults attack the terminal growths, squares, blossoms and immature bolls of cotton, and the damage results in excessive shedding of small squares and

immature bolls and in a tendency to rather abnormal tall growth. In one infested field planted late in November, the average number of fruiting forms per plant dropped from 19·1 to 11·1 between 30th March and 22nd April and the average crop loss was estimated as at least 40 per cent. The loss was therefore more severe in late planted fields.

The adult of *H. nobilellus* is briefly described. Its distribution is not accurately known, but it probably occurs throughout southern and south-western Brazil.

SAUER (H. F. G.). **Inimigos naturais da** *Platyedra gossypiella* **(Saunders) no estado de São Paulo. Vespas depredadoras e especies de parasitas com notas sobre a sua biologia.** [Natural Enemies of *P. gossypiella* in the State of São Paulo. Predatory Wasps and Parasites, with Notes on their Biology.]—*Arq. Inst. biol.* **9** pp. 187–199, 2 pls. S. Paulo, 1938. (With a Summary in English.) [Recd. 1939.]

During the season of 1936–37, the average infestation by *Platyedra gossypiella*, Saund., of the floral parts of cotton in the State of São Paulo was 42 per cent. Infested blossoms did not open fully, the larvae within having secured the petals by a web. Predacious wasps were found in December and January 1937 to have destroyed 87·6 per cent. of the larvae in such blossoms. Of 10 species taken in cotton fields, the most numerous, in order of increasing importance, were *Mischocyttarus cassununga*, Ihering, *Polybia sericea*, Ol., *P. occidentalis scutellaris*, White, and *P. atra*, Ol.

Parasites reared from bolls infested by *P. gossypiella* that were kept in cages were *Perisierola nigrifemur*, Ashm., an unidentified Bethylid of the same genus, *Spilochalcis simillima*, Ashm., two species of *Microbracon*, one of which is probably identical with *M. vulgaris*, Ashm., a species of *Apanteles* considered by C. F. W. Muesebeck to be undescribed, although it has been recorded in the Brazilian literature as *A. balthazari*, Ashm. [*R.A.E.*, A **8** 446], an undescribed species of *Ichneumon* (*Ephialtes*) that parasitises the pupa of *P. gossypiella* and was also reared from pupae of *Diaphania hyalinata*, L., and *Ephialtes* (*Calliephialtes*) *dimorphus*, Cushm. [**27** 86]. Pupae of an undetermined Encyrtid of a genus close to *Cerchysius* were observed in a larva of *P. gossypiella* hibernating in the fruit of *Hibiscus esculentus*.

Of these, *M. vulgaris* was the most important from February to June, followed by *Apanteles* sp., and *E. dimorphus* was the most numerous from July until the cotton fields were cleared. Females of *M. vulgaris* oviposited in up to 8 larvae per day, the average being 2·4. At 20°C. [68°F.], the period from oviposition to adult emergence averaged 26·7 days. Males and females were obtained in equal numbers. Females of *E. dimorphus* oviposited at the average rate of 8 eggs a day, but some individuals deposited up to 19. In some cases, 3 eggs were deposited on a single host larva, but only one gave rise to an adult. The females also fed on the host larvae, killing 15–18 in a day. The life-cycle from oviposition to adult emergence averaged 23 days, and the preoviposition period 12 days. Females lived for 34 days.

A number of other parasites were reared in cages containing infested bolls, but in addition to *P. gossypiella*, *Pyroderces rileyi*, Wlsm., and several other pests were also present.

Hambleton (E. J.). **A ocorrencia do ácaro tropical** *Tarsonemus latus* **Banks, (Acar. Tarsonemidae). Causador da rasgadura das folhas nos algodoais de S. Paulo.** [The Occurrence of the tropical Mite, *T. latus*, the Cause of the Tearing of Leaves in the Cotton Fields of S. Paulo.]—*Arq. Inst. biol.* **9** pp. 201–209, 1 fig., 5 pls., 5 refs. S. Paulo, 1938. (With a Summary in English.) [Recd. 1939.]

Of the mites that infest cotton in São Paulo, Brazil, the most important is *Tarsonemus latus*, Banks, all stages of which are described. Its distribution in the Western Hemisphere and in Brazil is discussed. The author has found it also on *Capsicum annuum*, *Dahlia* and *Zinnia elegans*. It breeds rapidly, only 3–5 days being required for the development of a generation, and is most abundant and injurious during the warm, rainy season. It feeds almost exclusively on the lower surfaces of the leaves, which become rigid and rolled under at the edges, and later split or crack open, assuming a ragged appearance. As all stages have been found as late as August, breeding may possibly continue through the winter. Dusting with finely powdered sulphur is recommended for control.

Hambleton (E. J.) & Sauer (H. F. G.). **Observações sobre as prágas da cultura algodoeira no nordeste e norte do Brasil.** [Observations on Cotton Pests in north-eastern and northern Brazil.]—*Arq. Inst. biol.* **9** pp. 319–330, 11 refs. S. Paulo, 1938. (With a Summary in English.) [Recd. 1939.]

A general account is given of the climate and topography of north-eastern and northern Brazil, where conditions for cotton growing vary considerably in different regions, followed by notes on the pests of cotton observed there in September and October 1938. The most important of these was the variety of *Gasterocercodes brasiliensis*, Hambl., previously recorded from Pernambuco [*R.A.E.*, A **27** 136]. It was parasitised by *Heterospilus annulicornis*, Mues., *H. gossypii*, Mues., and *Eurydinoteloides longiventris*, Gah. [*cf.* **26** 504].

*Platyedra gossypiella*, Saund., occurred everywhere, but losses due to it are greatest in the forest region, where the climate is most favourable to it, and in rainy years. The larvae were parasitised by *Microbracon vulgaris*, Ashm., *Apanteles* [?] *balthazari*, Ashm., *Perisierola nigrifemur*, Ashm., and *Spilochalcis simillima*, Ashm. *Alabama argillacea*, Hb., was widespread, and arsenical sprays are applied against it at the beginning of the rainy season. *Chalcodermus bondari*, Mshl. [*cf.* **27** 413] was common in the more humid regions. The Lygaeid, *Oxycarenus hyalinipennis*, Costa, was also commonly observed on cotton; it increases most rapidly in August and September, after the 3 months of dry weather.

The Tingid, *Gargaphia torresi*, Costa Lima, was found in many cotton fields, cotton being apparently one of its preferred food-plants. *Aphis gossypii*, Glov., occurred in the forest region, but is kept under control by Coccinellids, of which the most numerous were *Cycloneda sanguinea*, L., *Ceratomegilla maculata*, DeG., *Scymnus limbaticollis*, Muls., and *Hyperaspis festiva*, Muls. *Schistocerca australis*, Scudder, was common, but rarely abundant enough to cause much harm. *Atta sexdens*, L., was also common in the forest region, and injured some varieties.

Pests of minor importance observed on cotton included the Coccids, *Pinnaspis minor*, Mask., *Saissetia depressa*, Targ., *Phenacoccus gossypii*,

Tns. & Ckll., and *Pseudococcus brevipes*, Ckll., the Jassid, *Empoasca gossypii*, DeLong, the Pyrrhocorid, *Dysdercus maurus*, Dist., the Pentatomid, *Edessa meditabunda*, F., the Tineid, *Acrocercops helicomitra*, Meyr., the Cistelid, *Cteisa hirta*, Sol., the larvae of which are known pests of the roots of cotton in São Paulo, and the mites, *Tarsonemus latus*, Banks, *Tetranychus telarius*, L. (*bimaculatus*, Harvey) and *Eriophyes gossypii*, Banks.

**Plant Diseases. Insect Pests.**—*Bull. Wisconsin agric. Exp. Sta.* no. 443 (Rep. 1937–38) pp. 14–50, 11 figs., 1 graph. Madison, Wis., 1939.

The section of this report dealing with plant diseases in Wisconsin (pp. 14–33) includes a brief account of observations by R. H. Larson and J. C. Walker on yellow dwarf of potatoes. Serious outbreaks of this disease occurred in central Wisconsin during 1932 and 1937, but its severity was reduced in 1938, partly by cool, wet weather, which restricted the early breeding and delayed the later movement into potato fields of the clover leafhopper [*Aceratagallia sanguinolenta*, Prov.], which is a vector of the virus, and partly by the increased use of healthy seed potatoes. The amount of clover present does not apparently affect the severity of the disease, since the Jassid also feeds readily on lucerne, grasses and ragweed [*Ambrosia*]. Overwintered adults were collected as early as the end of March.

Doubt exists as to whether potato yellow dwarf is transmitted by the potato leafhopper [*Empoasca fabae*, Harr.] and Aphids, as well as by *A. sanguinolenta* [*cf. R.A.E.*, A **23** 1; **24** 36, 298], but it did not spread in 1937 in two counties in which *E. fabae* was prevalent, and in one of which potato mosaic, which is known to be transmitted by the peach aphis [*Myzus persicae*, Sulz.] and the potato aphis [*Macrosiphum solanifolii*, Ashm.], spread rapidly. Infected seed potatoes had been used in both these counties, but *A. sanguinolenta* was not abundant in them.

In the section on insect pests (pp. 34–50), accounts are given of the incidence of pests of various crops and of experimental work on them. Observations by J. A. Callenbach showed that infestation by the codling moth [*Cydia pomonella*, L.] of apples exposed to road dust was less marked in 1938 than in 1937 [**27** 33], since frequent rains laid the dust. It was found that sprays will not adhere to apples covered with dust, but form drops that run off them. An outbreak of the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] and the green apple aphis [*Aphis pomi*, DeG.], which have not previously caused serious damage to apple in Wisconsin, occurred in mid-July in the western part of the State.

Grasshopper eggs were numerous in the autumn of 1937, but the cool, wet summer of 1938 was unfavourable for hatching, and in districts with light sandy soil, in which it was most abundant, few hoppers reached the second instar. Grasshoppers were numerous in fields of grain in the north of the State, but caused more damage to lucerne and clover, in which they sheltered from the unfavourable weather. H. F. Wilson found that bait applied early in the morning or late in the evening was ineffective because it was dried by the wind before the grasshoppers became active, and that this effect was increased if the sawdust used in the bait was coarse. The recommended sodium-arsenite bait [**24** 64] was as effective as others in which 10 or

20 per cent. of the sawdust was replaced by mill feed, and gave a mortality of 90 per cent. within 24 hours. Partly decomposed sawdust remains moist longer than fresh sawdust, and the grasshoppers feed more readily on it. Experiments by J. H. Lilly showed that the loss of arsenic from 16 different baits exposed from 9th July until 22nd August and subjected to a rainfall of 6·33 ins. varied from 23 to 80 per cent. Those containing molasses reabsorbed moisture from damp air after drying rather more readily than the others, but all did so to some extent.

The wet season was unfavourable for cutworms, which were comparatively scarce in central Wisconsin. Studies by L. D. Beadle and Wilson showed that a bait containing Paris green [**27** 32] is effective against all species of cutworms, but not against sod webworms [*Crambus*], which cause part of the damage attributed to cutworms. More than 8,000 Noctuid moths were caught in three light-traps and two bait-traps during the season, but only one-third were females; traps therefore appear to be of little value in cutworm control.

Samples of eggs of *Lachnosterna* (*Phyllophaga*) spp. were collected by T. R. Chamberlin, L. Seaton, C. L. Fluke and Callenbach during June–September 1938 from 46 fields bearing 9 different crops in southern districts. Most were found in fields under blue-grass [*Poa*]; those under barley contained less than half as many, but more than those under oats or leguminous crops. None was found under clean cultivated maize. These results indicate the possibility of control by crop rotation. The adults emerge in numbers every third year, but although 1938 was a peak year and more than 24,000 beetles belonging to 18 species were collected between 26th April and 29th July, they were less abundant, except in two counties, than in 1935. *L.* (*P.*) *rugosa*, Melsh., *L.* (*P.*) *hirticula*, Knoch, and *L.* (*P.*) *fusca*, Fröl., were the most widely distributed and destructive, and comprised 40, 28 and 20 per cent., respectively, of the beetles collected during the year. Records are given of the trees on which they were taken. Of insecticides tested for spraying the trees, none killed the beetles quickly, but some considerably reduced the oviposition period. The best consisted of 2 lb. lead arsenate and 1 U.S. pint molasses in 50 U.S. gals. water.

Evidence obtained by E. M. Searls in southern Wisconsin indicated that in most years lucerne can be cut as early as 15th June without risk of serious injury by leafhoppers [*Empoasca fabae*] to later crops [**22** 277].

In view of the satisfactory results obtained with atomised sprays of oil containing pyrethrum for the control of *Empoasca fabae* on potato [*cf.* **25** 31], experiments were conducted by T. C. Allen and T. L. Carpenter to determine whether atomised oils could be used with safety on various vegetables, since they penetrate and adhere well, applications at the low rate of 10–12 U.S. gals. per acre are generally adequate and light spraying apparatus can therefore be employed. In trials in which vegetables and ornamental plants of many species were thoroughly wetted with oil, crucifers were not injured, whereas leguminous and solanaceous plants were more susceptible, but the evidence indicated that at the ordinary, lighter rates of application injury would be slight. An experiment by Searls [**27** 415] indicated that a single application of an effective insecticide would control the pea aphis [*Macrosiphum onobrychis*, Boy.] on canning peas if it was made at the early blossom stage. Observations

by Wilson in 1937 indicated that the Aphid was best controlled by rotenone dusts when these are applied early in the morning or late in the evening, probably because the dew causes the dust to adhere to the plants. In 1938, this was confirmed by Wilson and C. E. Dieter, who found that the dust was more effective, whatever the time of day, when applied while the plants were wet with dew or rain. In such cases, the dust was not washed from the plants by heavy rain 5–6 hours later. In both seasons, control from early applications was slow, especially in 1938, when the average temperature between 11th and 17th June was below 70°F. The recommended rate of application of a dust containing 1 per cent. rotenone is 25–30 lb. per acre, but under warm, wet conditions as little as 20 lb. can be used.

MICHELBACHER (A. E.) & ESSIG (E. O.). **Caterpillars attacking Tomatoes in the northern Tomato-producing Section of California.**—*Bull. Dep. Agric. Calif.* **28** no. 3 pp. 214–222, 2 figs., 3 refs. Sacramento, Calif., 1939.

The information in this paper is intended to supplement and bring up to date that contained in a bulletin already noticed [*R.A.E.*, A **27** 431]. The damage caused by *Heliothis armigera*, Hb. (*obsoleta*, F.) fluctuates from field to field and from season to season. The results of surveys of infestation by *H. armigera*, *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, and *P.* (*G.*) *operculella*, Zell., in fields in 10 counties late in the 1938 season are given in tables. Infestation by *H. armigera*, in contrast with 1937, was exceptionally light. Insecticide dusts were applied by hand in 1938 with results that compared favourably with those given by other methods in previous years.

SMITH (R. H.). **Observations on the Ilicis Mite, *Paratetranychus ilicis* McGregor.**—*Bull. Dep. Agric. Calif.* **28** no. 3 pp. 240–242, 5 refs. Sacramento, Calif., 1939.

In October 1938, the leaves of walnut trees in southern California were found to be infested by *Paratetranychus ilicis*, McGregor. All Persian walnuts examined in West Los Angeles and Santa Monica and about half the walnut trees examined between Los Angeles and Santa Barbara in October were infested. In a survey made in November of the food-plants and distribution of the mite between Los Angeles and San Francisco, it was found to be prevalent on various shrubs and on planes [*Platanus*] on the coast road as well as on walnut. The lower portions of the trees were usually more heavily infested than the higher, and trees in dry situations were more seriously affected than those on irrigated land. Injury, which consists in discoloured patches, is practically limited to the upper surface of the leaf and is not discernible on the lower surface. Infestation usually begins along the mid-rib. A portion of a leaf may be severely injured and bear large numbers of mites and the remainder be practically uninjured. No abnormal shedding of infested leaves was observed. Previous records are given [*R.A.E.*, A **5** 167; **20** 85; **21** 337] of the occurrence of the mite, which appears to have been recorded in California for the first time in 1935 on plane. Studies extending over two years indicated that it is a major pest of several ornamental shrubs and trees. It is the most prevalent and important Arthropod pest of *Cotoneaster* spp., *Pyracantha* spp., plane, camphor, loquat

[*Eriobotrya japonica*] and *Eucalyptus globulus* in southern California, and potentially an important pest of walnut. Rather heavy infestations have been observed on pear and quince.

SMITH (F. F.). **Control of Cyclamen and Broad Mites on Gerbera.**—*Circ. U.S. Dep. Agric.* no. 516, 14 pp., 9 figs., 2 refs. Washington, D.C., 1939.

*Tarsonemus pallidus*, Banks, is one of the most destructive pests of gerbera (*Gerbera jamesoni*) when this is grown as a florist's crop in greenhouses in the United States. *T. latus*, Banks, also causes severe damage and is sometimes associated with *T. pallidus*. Both feed on young foliage and flower buds, and cause bronzing of the lower leaf surfaces, crinkling and curling of the leaves and distortion and fading of the petals. *T. latus* is responsible for serious injury to the whole plant, but does little damage during the winter, when *T. pallidus* is breeding and causing damage to the flowers. The latter is the more serious pest, since its presence is usually undetected until the injury appears on the flowers, and it is not controlled by the usual practices [*cf. R.A.E.*, A **23** 315]. *T. latus* is readily killed by sulphur dust [*loc. cit.*], two or three applications of which, at five-day intervals, ensure effective control. Other methods are not recommended against this mite on gerberas, which are very tolerant to sulphur dust.

Complete control of *T. pallidus* was obtained by vapour-heat treatment for 30 minutes at 110°F. or by immersing the plants for 15 minutes in water at the same temperature [*cf.* **22** 128]. In the latter case, it was necessary for the plants to be in a thin layer on a tray of wire netting to permit uniform penetration of the heat. Exposure to vapour heat slightly damaged one variety of gerbera after an hour, and all varieties after two hours. No plants were injured by immersion for 20 minutes, but longer immersion damaged the foliage of some varieties. In practical control operations, 60,000 plants were successfully treated with hot water, and no mites were found among them during the two successive growing seasons. The treatment procedure adopted, which included careful precautions to prevent re-infestation, is described. Further experiments indicated that gerberas could not be safely treated if the temperature of the water and the duration of exposure were increased to control Nematodes, or if antiseptic chemicals used against certain diseases were added to the water.

Other pests of gerberas, including *Trialeurodes vaporariorum*, Westw., *Myzus persicae*, Sulz., *Hercinothrips femoralis*, Reut., *Thrips tabaci*, Lind., *T. nigropilosus*, Uzel, and *Tetranychus telarius*, L., are controlled by fumigation with calcium cyanide or by spraying, and *Agromyza pusilla*, Mg., which is sometimes heavily parasitised by *Derostenus variipes*, Cwfd., by picking and destroying infested leaves, or by spraying with derris or nicotine extracts.

DOWDEN (P. B.). *Schizonotus sieboldi*, **an important Parasite of the imported Willow Leaf Beetle** (*Plagiodera versicolora*).—*J. agric. Res.* **58** no. 8 pp. 581–592, 3 figs., 14 refs. Washington, D.C., 1939.

The adults of the Chrysomelid, *Plagiodera versicolora*, Laich., which since 1916 has become a serious pest of willow in the north-eastern United States, overwinter under loose bark or in crevices in trees. In

Massachusetts, the first eggs are found about 15th May, and the first pupae about 10th June. There are three overlapping generations and a partial fourth during the summer. Pupae heavily parasitised by *Schizonotus sieboldi*, Ratz., were found in Massachusetts in 1932 [*R.A.E.*, A **21** 344], and studies on the bionomics and effectiveness of this Pteromalid were carried out during 1934–37. It was present in all areas from which pupae of *Plagiodera* were obtained. Weekly field collections made during 1934–35 at three places in Massachusetts and single ones made in 1936 at the same places and at three in Connecticut, the results of which are shown in tables, indicated that a fairly high degree of parasitism prevailed, but the intensity of infestation by the beetle appeared to be unaffected and remained severe throughout the three years.

*Schizonotus* passes the winter in the adult stage, probably under loose bark or among débris, and produces two or three generations a year. In hibernation experiments in 1936–37, some females of the third generation and a very few of the first survived until the first host pupae were available in June, but the males had died before 6th May. In open air studies in Massachusetts during 1935, first-generation adults emerged on 2nd–8th July from host pupae collected on 17th June, and the females oviposited on 6th–10th July. Adults of the second and third generations emerged on 22nd–24th July and 12th–14th August, respectively. Eggs were deposited by second-generation females on 26th–30th July, and a few were laid by third-generation females, though most of the latter probably hibernated. A fourth-generation adult emerged on 1st September. These conditions are probably closely approximated in the field.

The average periods of survival of adults fed on dry loaf sugar and honey solution were 7 days for males and 27 days for females allowed to oviposit. The preoviposition period was 2 or 3 days, and the eggs were laid singly on the host pupae. The average number of eggs laid was 181, but one female laid 424, ovipositing on 35 days out of 36. Unfertilised females produced male offspring. Eggs and a larva of *Schizonotus* were observed on prepupae of *Plagiodera* in the field. In the insectary 103 prepupae were attacked, and adults of *Schizonotus* emerged from 34 of the 37 that pupated and from 5 of the 66 that did not. The period from oviposition to adult emergence in the insectary was usually 14–16 days, the egg stage lasting 36–48 hours and the pupal stage about a week. From 300 parasitised pupae collected in the field, 328 males and 327 females of *Schizonotus* were reared. The numbers of pupae that produced 1, 2, 3, 4, 5 and 6 parasites, respectively, were 63, 142, 75, 18, 1 and 1, and 180 pupae produced adults of both sexes. It is thought that the larvae in a superparasitised pupa usually die of starvation ; they were not observed to prey upon each other [*cf.* **6** 551].

Two hyperparasites, *Pleurotropis tarsalis*, Ashm., and an undescribed species of *Tetrastichus* were found to attack *Schizonotus* in almost every locality from which it was collected, and the extent of parasitism by *Tetrastichus* was sometimes high. Both species oviposit directly into their host. As *P. tarsalis* is known to be both a secondary and tertiary parasite [**15** 545], it is possible that it may parasitise *Tetrastichus* as well as *Schizonotus*. Adults of the overwintered generation of *Tetrastichus* emerged at the end of May. Some first-generation larvae hibernated, but some first-generation adults emerged as early as 28th June, and adults of a later generation appeared in September.

The systematic position of the genus *Schizonotus* is discussed, the immature stages of *S. sieboldi* are described, and its distribution in Europe and the United States is reviewed. It has been recorded as a parasite of species of *Melasoma* (*Chrysomela*) in the United States and Germany [*cf.* **6** 551 ; **14** 383] and was found in the United States long before *P. versicolora* was introduced.

Fox (H.). **The probable future Distribution of the Japanese Beetle in North America.**—*J. N. Y. ent. Soc.* **47** no. 2 pp. 105–123, 25 refs. Lancaster, Pa, 1939.

The following is based on the author's summary ; The known reactions of all stages of *Popillia japonica*, Newm., to different degrees of temperature and humidity indicate its adaptation to countries with a range of temperature capable of keeping the mean summer temperature of the soil occupied by it within the limits (63·5 and 81·5°F.) favourable for the hatching of the eggs and the survival of the larvae, and with a precipitation copious in amount and rather uniformly distributed throughout the year. The average temperature of the soil in the type of ground inhabited by *P. japonica* throughout most of its life-cycle is slightly higher than that of the air during its period of growth and development. Precipitation influences survival in summer, during the season of egg deposition and hatching, by affecting the moisture content of the soil, and in winter by providing a layer of snow that keeps the temperature of the soil above the lethal point (15°F. under natural conditions). The spread of *P. japonica* in Japan is probably limited in the north by the low temperatures of the summer rather than by those of the winter. In the south it is limited by the sea, so that the insect may be able to establish itself in countries that have a warmer climate than Japan. In the United States, the normal conditions of temperature and precipitation resemble those of Japan in the region east of the 100th Meridian and extending from the lower Canadian provinces to the upper limits of the Cotton Belt, formed by the summer isotherm of 77°F. Within these limits, the beetle is likely to find conditions most congenial in the section bordering the Atlantic. Rainfall, especially in summer, is the major limiting factor in determining its future range in North America. It is not likely to become generally established in the arid or semi-arid conditions of the western half of the continent. Between the Great Lakes and the Atlantic, where the precipitation is normally copious throughout the year, the effective barrier to its northward spread will be the low temperature of the summer rather than the severity of the winters. Between the Great Lakes and the Missouri River, and in the same general latitude as the former, where the precipitation in winter is normally light, the extreme cold of the winters and the wide-spread absence of snow are likely to prevent it from spreading northwards.

Soraci (F. A.). *Neodiprion sertifer.*—*J. N.Y. ent. Soc.* **47** no. 2 p. 124. Lancaster, Pa, 1939.

Forest plantations and ornamental trees of red pine and Scots pine [*Pinus resinosa* and *P. sylvestris*] near Gladstone, New Jersey, have recently been severely damaged and in some cases completely defoliated by *Neodiprion sertifer*, Geoffr. Eggs of this sawfly were found on the needles of *Pinus ponderosa* on 1st May 1939, and later the larvae were observed feeding on the needles.

Haseman (L.) & Brown (H. E.). **Controlling the Fruit-tree Leaf Roller.**—*Circ. Mo. agric. Exp. Sta.* no. 203, 4 pp., 2 figs. Columbia, Mo., 1939.

In the spring of 1938, the fruit-tree leaf roller, *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., appeared in destructive numbers in orchards in Missouri, particularly in the east of the State, for the first time since 1905. Since the set of fruit in central and eastern Missouri was light, on account of late frosts, the damage caused was out of all proportion to the number of larvae present.

A survey made in the autumn showed that the infestation was concentrated in several counties near St. Louis. In some orchards, in which individual trees bore 50–100 overwintering egg clusters, or 5,000–10,000 eggs, serious damage to foliage and fruit appeared likely to occur in 1939. Brief notes are given on the appearance of all stages of this Tortricid, which has one generation a year. Clusters of 25–75 or more eggs are attached to the twigs and limbs of the trees and cemented over. The larvae usually hatch when the apple buds are in the cluster stage and feed first on the flower and leaf buds and later on the fruits and leaves, webbing the latter together or to the developing fruits. They pupate in the folded leaves, and the adults emerge 7–10 days later. They are inactive during the day, but on warm days they begin to fly at dusk. The female lays 100–200 or more eggs, usually in two or more clusters, within a week after emerging. In addition to apple, pear, plum and cherry, most forest and shade trees and shrubs, particularly oak, elm and *Sassafras*, are attacked. In orchards, the trees near woods are the most heavily infested.

If the average number of egg masses per tree is as high as 25–50, a dormant oil spray containing 6 per cent. actual oil should be applied. Thorough spraying is essential as most of the eggs are laid on the upper side of the twigs. If the infestation is less severe, two applications of a spray containing 2–4 lb. lead arsenate per 100 U.S. gals., one in the late cluster bud stage and the other immediately after petal fall, will kill most of the newly hatched larvae before they spin their protective coverings in the leaves. If the infestation is particularly heavy, arsenical sprays may be needed in addition to the dormant oil spray.

Eyer (J. R.). **Field Comparisons of Insecticides for Control of the Codling Moth.**—*Bull. N. Mex. agric. Exp. Sta.* no. 259, 44 pp., 2 figs., 11 graphs, 21 refs. State College, N. Mex., 1938. [Recd. 1939.]

The following is mainly from the author's summary: Experiments carried out from 1928 to 1937 with sprays against *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in southern New Mexico showed that only lead arsenate insured a consistently high degree of freedom from infestation. A calyx and five cover sprays of lead arsenate gave 85–95 per cent. sound fruit; a schedule in which lead arsenate was used in the first three applications and an organic insecticide such as oil and nicotine or thiodiphenylamine (phenothiazine) in the last three gave only 65–75 per cent. When the use of lead arsenate was confined to the first two sprays, only 50–65 per cent. sound fruit was obtained. When three applications of lead arsenate were made, the arsenic residue at harvest nearly always exceeded the tolerance of

0·01 gr. $As_2O_3$ per lb. of fruit ; but when only two applications were made, the residue was nearly always below tolerance. Of the possible substitutes for lead arsenate, cryolite was the most promising substance tested, but the number of applications that can be made is also limited by the residue tolerance. Of the many adhesives and spreaders included in the tests, copper resinate oil and bentonite clay gave promising results. The former left a smooth and uniform deposit and the latter a heavy spotted one. Of other spreaders tested on individual trees, a triethanolamine oleate and mineral oil spreader known as W.S.C. Dynamite [*R.A.E.*, A **25** 652] and a proprietary colloidal spreader gave both the highest degree of control and the largest arsenic deposit. In general, the control obtained was in direct proportion to the amount of arsenic deposited. Weather conditions, particularly dry, hot summers, apparently interfere with the efficiency of organic insecticides such as nicotine and oil or thiodiphenylamine. When conditions are favourable to *C. pomonella*, effective control without excessive spray residue is difficult to obtain in New Mexico. As the cost of producing apples in the southern part of the State is particularly heavy, schedules necessitating costly washing procedures are not recommended. The importance of further investigations is emphasised.

Sullivan (W. N.), Goodhue (L. D.) & Haller (H. L.). **Rotenone Series Compounds. A Study of Toxicity to the Housefly of Optically Active and Inactive Compounds of the Rotenone Series.**—*Soap* **15** no. 7 pp. 107, 109, 111, 113, 2 figs., 18 refs. New York, N.Y., 1939.

The following is the authors' summary: Rotenone, laevo-dihydrorotenone, laevo-beta-dihydrorotenone, laevodeguelin concentrate, racemic deguelin, and racemic dihydrodeguelin have been tested against the house-fly (*Musca domestica*, L.). In acetone solution, the two optically inactive (racemic) compounds are much less toxic than are the optically active ones ; but when tested in highly refined kerosene containing cyclohexanone, the toxicity of the racemic compounds is practically the same or only slightly less than that of the optically active compounds. A concentrate containing more than 80 per cent. of laevodeguelin has been prepared.

[**Papers on Orchard Pests and their Control.**]—*Trans. Ill. hort. Soc. 1938* **72** 527 pp., illus. Springfield, Ill., 1939.

In Directions for Spraying Fruits in Illinois, by W. P. Flint & H. W. Anderson (pp. 64–92), which is a revision of a circular already noticed [*R.A.E.*, A **23** 624], a brief discussion of spraying for the control of insect pests and fungous diseases of fruit is followed by a section containing schedules of sprays to be applied to fruit trees and small fruits in Illinois. Directions for preparing and mixing spray materials are given in a third section, and notes on commercial preparations in a fourth.

In New Attacks on the Plum Curculio and Peach Borer, by S. C. Chandler (pp. 182–197), the relative merits of ethylene dichloride emulsion and paradichlorobenzene for the control of the peach borer [*Aegeria exitiosa*, Say] are briefly discussed [*cf.* **27** 255, 526], and work on the plum curculio [*Conotrachelus nenuphar*, Hbst.]

is reviewed in some detail. Figures are given for the infestation of peaches by this weevil in Illinois in 1938. The average percentage infested increased from 2·04 in 1937 to 4·27 in 1938, apparently because the high rainfall of 1937 resulted in a large emergence of adults in the summer, most of which did not oviposit until the following spring. Work in Illinois and Kentucky showed that most adults hibernate outside the peach orchards, and migrate to them in spring, first infesting the trees at the edges. This probably accounts for the great irregularity in infestation that was observed in Illinois. Emphasis is laid on the value of jarring the trees in spring to obtain an estimate of infestation, which permits the adoption of appropriate measures of control. In tests in 1938, sprays containing synthetic cryolite and lead arsenate, at rates of 4 and 3 lb., respectively, per 100 U.S. gals., and an oil-impregnated dust containing 10 per cent. lead arsenate [*cf.* **26** 653] were each applied twice, and the percentages of control obtained were 58·4, 75·2 and 71·2, respectively. The results are given of small-scale cage tests in Georgia, from which it is considered that if the proportion of cryolite were increased to 4½ lb. in Illinois, it would be about as effective as the spray of lead arsenate. The cryolite spray caused no injury to fruit or foliage in 1938, while the lead-arsenate spray caused moderate leaf-fall in some orchards. Cryolite was less effective as a dust than as a spray in orchard tests in 1937.

In September 1938, the quantity of lead residue permitted on fruits shipped interstate in the United States was raised from 0·018 to 0·025 grain per lb. The fluorine tolerance was raised from 0·01 to 0·02 grain per lb. later in the year. In Effect of new Tolerance and other possible Changes on Residue Removal (pp. 197–212), W. A. Ruth states that on early apples in Illinois, one calyx and one cover spray of lead arsenate followed by sprays of nicotine and oil will not leave a residue greater than the new tolerance, provided that the cover spray is not delayed and that rainfall is normal. In 1936, when a full programme of sprays of lead arsenate, lime and oil had been followed, lead residues were brought within the new tolerance by washing the apples at 70°F. in an under-brush flood-type washer when a wetting agent was used. Washing for 30 seconds in 1¼ per cent. hydrochloric acid with the addition of a wetting agent (Vatsol) and defoamer reduced the residue on fruit sprayed throughout the season with lead arsenate by 86–88 per cent. at 70°F. and by 94–95 per cent. at 110°. The residues on fruit sprayed with lead arsenate and oil, followed by nicotine sulphate and oil, were reduced by 48 and 73 per cent. at the two temperatures, respectively.. In both cases, the residue at 70° was approximately halved by raising the temperature to 110°. The lower temperatures that now suffice have already reduced the damage caused to apples by washing in the north-west of the United States. Other probable effects of the increase in lead tolerance are discussed, and the text of the notice of the change, issued by the United States Department of Agriculture, is appended.

In Codling Moth Insecticide Investigations in 1938 at the Vincennes Laboratory (pp. 439–461), L. F. Steiner, J. E. Fahey & S. A. Summerland report on work against the codling moth [*Cydia pomonella*, L.] on apple in southern Indiana in 1938 in which the standard tank mixture of nicotine sulphate, bentonite, soy-bean oil and sodium lauryl sulphate [**26** 732] was more satisfactory than several variations of it. If the spray was allowed to stand for several

hours after the materials had been thoroughly mixed, only slight agitation was necessary to reproduce a uniform dispersion of the flocculated particles. Applications were begun when the larvae started to hatch, and eight cover sprays were given, in the last four of which the quantity of nicotine sulphate and bentonite was reduced by 33 per cent. The substitution of 2 U.S. quarts mineral oil, ⅔ U.S. pint nicotine sulphate and 1 lb. bentonite per 100 U.S. gals. in the last three cover sprays caused a slight loss of efficiency, but the fruit did not need washing. The addition of various oil emulsions to nicotine sulphate in the last two sprays reduced the visible bentonite residue on non-waxy apples, but was ineffective on waxy varieties. A paste type of emulsion was slightly more effective in facilitating subsequent removal, but gave rather lower control. A 5 per cent. sodium-silicate wash with 0·5 per cent. oil in brush machines effectually cleaned all varieties. The omission of sodium lauryl sulphate in one test did not reduce the efficiency of the spray except towards the end of the season, 30 days after spraying. Sodium lauryl sulphate may maintain a higher efficiency in rainy weather if the intervals between sprays are unusually long, but it is considered advisable to omit it until further investigations have been made, owing to the danger of using too much. When the first nicotine-bentonite spray followed one of lead arsenate for the control of *Conotrachelus*, its effectiveness was reduced if the latter had contained lime. Lime or Bordeaux residues apparently liberate some of the nicotine. No injury due to the use of the tank mixture was observed, but trees sprayed with 0·5 per cent. mineral oil with a commercial fixed nicotine showed severe injury.

Details are given of 5 series of cover sprays applied after a calyx spray of lead arsenate to plots scattered about an unsprayed orchard, to determine the effect on their efficiency of heavy and continuous migration of adults. Only two generations of larvae developed in the orchard. The percentages of apples clean, " stung " and containing larvae were 40·2, 58·2 and 7·5 after nine cover sprays containing lead arsenate, 75·2, 14·4 and 13·5 after eight applications of the tank mixture, 65·3, 16·6 and 22·9 after eight sprays of 4 lb. thiodiphenylamine (phenothiazine) in 100 U.S. gals. water, and 19·6, 34·6 and 71·8 on trees receiving no cover sprays. The lead residue averaged 0·246 grain per lb. at harvest, which amount is almost impossible to reduce to within tolerance without the use of heated acid washes. The visible bentonite residue was readily removed. In large-scale experiments, nicotine-bentonite was very nearly as effective as lead arsenate in preventing infestation and more effective in preventing " stings," while catches of moth in areas sprayed in the previous year indicated that it reduced the overwintering population more than lead arsenate. The results are also recorded of observations on the effect on spray deposits of fruit growth and weather, and on the percentages of apples that were entered at or near the calyx after receiving different sprays. It was found to be difficult to maintain adequate protection in the tops of the trees with any insecticide, and it is considered desirable to make extra applications to the top third of the tree.

In 1938 Results with Lead Arsenate Substitutes (pp. 501–511), M. D. Farrar, Chandler, D. Powell & Flint give the results of experiments with four spray schedules against *C. pomonella* in different parts of Illinois in 1938. In order of efficiency they were lead arsenate, tank-mixed nicotine-bentonite, a commercial fixed nicotine and a

mixed schedule of lead arsenate, cryolite and a fixed nicotine. Trees sprayed with lead arsenate had more "stung" fruits but fewer containing larvae than those sprayed with the fixed nicotine or the tank-mixture, and were russeted by the weak Bordeaux mixture used to protect them from lead-arsenate injury. The first three treatments gave approximately equal numbers of clean apples. It is considered that sprays of lead arsenate and oil are more effective under conditions of heavy infestation and inexact timing of sprays, and nicotine when frequent, well-timed sprays can be given.

WALKER (H. G.) & ANDERSON (L. D.). **Sweet Corn Variety Tests in Relation to Corn Earworm Damage at Norfolk, Virginia.**—*Bull. Va Truck Exp. Sta.* no. 100 pp. 1581–1593, 13 refs. Norfolk, Va, 1938. [Recd. 1939.]

The cultivation of sweet maize in Tidewater Virginia is limited because of the serious damage caused to it by *Heliothis armigera*, Hb. (*obsoleta*, F.) [*cf. R.A.E.*, A **26** 144]. Experiments were begun in 1934 to compare the resistance to attack of newer varieties of sweet maize with that of other varieties that are common in this part of Virginia. Tables are given showing, for the years 1934–38, the interval between planting and harvest, the weight, number and condition of the ears and the degree of injury caused by *H. armigera* and, except for 1934, the length of the ear, and of the husk extending beyond the tip of the ear, and the number of rows of grains on 25 ears selected at random. Some varieties were consistently more seriously injured than others. Freedom from injury appeared to be associated with thick, close-fitting husks and with late maturity. The length of husk projecting beyond the tip of the ear was not necessarily important. In 1937 and 1938, sweet maize planted to mature between mid-July and early August was found to be the least liable to injury. The early-maturing varieties tested were all so badly injured that it is considered impracticable to grow them commercially. Some of the later-maturing varieties produced 69–98 per cent. of ears free from serious damage when planted in April or May. Varieties suitable for planting in this part of Virginia are briefly discussed. Sweet maize planted after about the middle of June is frequently so badly injured by *H. armigera* and the fall armyworm [*Laphygma frugiperda*, S. & A.] that such late planting is not recommended.

IMLE (E. P.) & HARTZELL (A.). **A Cecidomyid Larva infesting Flowering Stems of Lilies.**—*Contr. Boyce Thompson Inst.* **10** no. 3 pp. 277–279, 1 fig., 4 refs. Menasha, Wis., 1939.

Stems of *Lilium auratum* 4–6 ft. high and growing in nursery rows among evergreens in New York were found on 29th July 1937 to be infested by Cecidomyiid larvae that gave rise on 3rd August to adults identified as *Neolasioptera hibisci*, Felt. The upper leaves and flower buds of most of the infested plants were injured; in some cases, the youngest buds were killed, and some of the lower ones became blackened at the base or developed blackened necrotic areas that extended down one side and caused splitting and distortion. Normal flowers were produced from the lower buds on a few of the plants. The upper leaves were killed, and the lower ones developed necrotic areas and turned pale yellow or brown. The larvae fed in the pith and sometimes infested as much as the top third of the stem; they also occurred in

the pedicels, and in some cases penetrated into the bud itself, passing through the ovary into the lower half of the style. Small exit holes, frequently with cocoons in their vicinity, often occurred on the upper part of the stem.

This Cecidomyiid has also been obtained from other species of *Lilium* in New York and has been recorded from *Hibiscus moscheutos* there [*cf.* also *R.A.E.*, A **7** 322]. A description of the larva is quoted.

BRYSON (H. R.). **Some recent Observations on the Activities of *Phyllophaga lanceolata* Say (Scarabaeidae).**—*J. Kans. ent. Soc.* **12** no. 3 pp. 94–96. Manhattan, Kans., 1939.

The dry weather in the years 1935–38 has apparently caused the range of *Lachnosterna* (*Phyllophaga*) *lanceolata*, Say, in Kansas to extend northwards. This beetle is known to occur in every county in the eastern half of the State, but injury to wheat by it is usually reported only from the south-central counties [*cf. R.A.E.*, A **7** 227]. Damage occurred as far north as Cloud county in 1937 and adults were abundant in wheat fields in Osborne county in 1938. An apparent increase was noticed in the numbers of beetles on a golf course in 1937 and they were still more abundant in 1938. The grass in the fairways had been weakened by close clipping and exposure to the hot sun as well as by the feeding of the larvae, and weeds, particularly dandelions, had become established. The adults are diurnal, and as many as 339, of which 208 were females, were collected during a single 2-hour period before 10 a.m. The females, which are wingless, fed consistently on leaves of dandelion, as well as those of other plants. As the temperature rose during the morning, the beetles crawled into the rough grass or burrowed into the soil. Where they had been feeding on dandelion, they burrowed directly beneath the plant. Pairing was observed, and the females, which contained 11–26 eggs, were apparently ovipositing in the area. Both sexes were parasitised by Sarcophagids.

**The Pest Control Products Act (Office Consolidation of the Agricultural Pests' Control Act, 1927, as amended in 1939).** 13 pp.—Ottawa, Canada Minist. Agric., 1939.

Under this Act, no product for the purpose of pest control may be sold in Canada unless it has been registered. An application for registration of a product must be accompanied by a statement of various particulars including the percentage by weight of each ingredient and the purpose for which it is offered for sale. Products manufactured from an unsolicited prescription submitted by the purchaser may be sold without registration under certain conditions. Any purchaser of a pest control product may obtain an official analysis of it on payment.

TIMONIN (M. I.). **Pathogenicity of *Beauveria bassiana* (Bals.) Vuill. on Colorado Potato Beetle Larvae.**—*Canad. J. Res.* (D) **17** no. 4 pp. 103–107, 5 figs., 3 refs. Ottawa, 1939.

Dead larvae of *Leptinotarsa decemlineata*, Say, collected from a potato field in New Brunswick during September 1935 were found to be infected with a fungus that was later identified as *Beauveria bassiana*

but that differed in general appearance from cultures of the same species previously isolated from larvae of the European corn borer [*Pyrausta nubilalis*, Hb.]. A description is given of the fungus cultured from *L. decemlineata*, and characters distinguishing it from *B. doryphorae* [*R.A.E.*, A **23** 290] are indicated.

The fungus was cultured on soy-bean mash for field experiments, and, on 15th July 1936, the spores were dusted on to larvae in the last instar on three potato plants in a field. These and a fourth plant that served as a control were then caged. Three days later, brown lesions were observed under the epidermis of infected larvae, which became less active and died shortly after the lesions had attained a diameter of 2–3 mm. [*cf.* **23** 391]. Their bodies were found to be filled with mycelium, some of which also developed superficially. Most of the dead larvae fell to the ground, and more superficial mycelial growth was observed on them than on those that remained attached to the leaves. Some infected larvae entered the soil to pupate, and many became mummified and surrounded by a layer of soil bound by ramifying hyphae after 3–4 days. Some infected larvae pupated, but dark areas were still apparent on the pupae. A table shows the numbers of larvae that were treated, the numbers infected three days after dusting, the numbers of dead larvae observed after 6 and 14 days, the numbers of healthy and infected pupae, and the percentage survival, which varied from 0 to 16, as compared with 95 for untreated larvae. Four infected pupae buried 2 ins. deep in soil in a pot in a greenhouse became mummified after 4 days, whereas healthy pupae kept under the same conditions all gave rise to adults in this period. Weather conditions during the investigations were warm and moist, and thus favoured the growth of the fungus.

Further observations on unenclosed plants indicated that the eggs are not susceptible to attack, but larvae were observed to be dying four days after hatching from eggs that had been dusted with spores.

CRAWFORD (H. G.). **Insects as a Factor in Wheat Production on the Canadian Prairies.**—*Canad. geogr. J.* **18** no. 4 pp. 217–224, 12 figs. Montreal, 1939.

Insects are probably responsible for an annual loss of at least 10 per cent. of the wheat crop in western Canada, and in years of serious grasshopper outbreak, would destroy 75 per cent. of all crops in the Prairie Provinces but for widespread and vigorous control measures. They also cause considerable waste of seed, labour, time and money. During a severe outbreak of grasshoppers, of which the most important are *Camnula pellucida*, Scudd., *Melanoplus mexicanus*, Sauss., and *M. bivittatus*, Say, farmers have to spend at least two months of the year on their control, at a time when the crop is least vigorous, owing to drought, and when such insects as cutworms and wireworms are causing their maximum damage. The cost of grasshopper control varied from about £20,000 to about £150,000 a year between 1932 and 1938, but it was estimated that the value of the grain saved in Manitoba in 1938 was about £6,000,000. In consequence of the tremendous total acreages and more or less contiguous distribution of plantings of wheat, and the large areas through which, as a rule, the more harmful species are distributed, an outbreak of a major insect pest is of national importance.

Notes are given of the bionomics and control of some of the principal pests, including grasshoppers, wireworms, the cutworms, *Agrotis orthogonia*, Morr., and *Euxoa ochrogaster*, Gn., and the wheat-stem sawfly, *Cephus cinctus*, Nort.

DE GRYSE (J. J.) & BROWN (A. W. A.). **Co-operative Forest Insect Survey.**—Paper prepared for the Annual Meeting of the Woodlands Section, Canadian Pulp and Paper Association no. 481, 4 pp., 2 figs. Montreal, 1939.

The authors review the development of the Forest Insect Survey of Canada and the system on which it is carried out [*cf. R.A.E.*, A **26** 534]. It is designed to show the conditions over whole areas at a given time, and the increase in the number of samples taken for this purpose from 1936 to 1938 is recorded in maps and tables. Over 5,000 samples were taken in 1938, and the organisation now extends practically from coast to coast. Further maps are given showing the distribution in 1938 of the European spruce sawfly [*Diprion polytomum*, Htg.], the spruce budworm [*Harmologa fumiferana*, Clem.], the forest tent caterpillar [*Malacosoma disstria*, Hb.] and the larch sawfly [*Pristiphora erichsoni*, Htg.]. The life-histories, yearly abundance and possible importance of over a hundred insects feeding on forest trees and of their parasites are being studied, and information on them is published in an annual report.

WATERSTON (J. M.). **Report of the Plant Pathologist, 1938.**—*Rep. Dep. Agric. Bermuda 1938* pp. 22–34. Hamilton, 1939.

Part of an experimental shipment of potatoes sent from Bermuda to England late in May 1938 was found on arrival to be infested by *Phthorimaea operculella*, Zell., but it is considered unlikely that infestation would occur earlier in the season and so hinder the export of early potatoes. Larvae of *Xylomyges* (*Prodenia*) *eridania*, Cram., *Psara periusalis*, Wlk., and *Feltia subterranea*, F., which were extremely numerous as a result of abnormally mild, wet weather during October and November, caused severe injury to early potatoes and strawberry plants. The numbers of larvae of *F. subterranea* taken on young grass in November varied from 3 to 5 per sq. ft. Effective control of this cutworm was obtained with a poison bait of 1 lb. Paris green and 10 lb. pollard. Brief notes are given on Arthropods that infest Bermuda cedar (*Juniperus bermudiana*). They include various Psocids and mites that are not injurious, unidentified Tetranychids that may possibly cause damage, and the Flatid, *Ormenis infuscata*, Stål, a Jassid of the genus *Deltocephalus*, and the Geometrid, *Alcis verrillata*, Dyar,* which attack the foliage. The other pests have already been noticed [*R.A.E.*, A **24** 137; **26** 220], but the dry-wood termite that is the most injurious of them [and was previously recorded as *Calotermes castaneus*, Burm. (**26** 220)] is here stated to be *C.* (*Kalotermes*) *approximatus*, Say [sic ? *approximatus*, Snyder]. Besides attacking Bermuda cedar, dry-wood termites cause considerable damage to timber of all kinds in the Colony; another species, *Calotermes* (*Cryptotermes*) *brevis*, Wlk., is frequently a serious pest of timber in buildings.

Two shipments of *Selenothrips rubrocinctus*, Giard, containing pupae

* We are informed by Mr. L. B. Prout that *Alcis verrillata*, Dyar, is a synonym of *Thamnonoma ochrifascia*, Warren.—Ed.

of *Dasyscapus parvipennis*, Gah., were imported at the beginning of the year from Trinidad in an attempt to establish this Eulophid for the control of *Thrips tabaci*, Lind., on onion [**26** 626]. From a consignment of 1,000 pupae received on 17th January, the only adult parasites obtained were 4 males that emerged 11 days later, but a second consignment of 3,000 pupae from which 54 adults had already emerged arrived on 7th February, and 280 adults emerged during the next two days. The numbers of each sex that emerged on each day are shown in a table. On 10th February, 150 fertilised females, 40 males and 810 pupae were liberated on an infested plot of onions, and on the following day, 1,000 pupae from which 50 parasites had already emerged were placed with 50 thrips in a glass container in a greenhouse. The weather at the time of the liberations was cool (58°F.), dull and windy ; three parasites were recovered from the plot and one in the greenhouse on 8th March, but none was observed subsequently.

*Tetranychus telarius*, L., injured carnations in May and June, but was controlled by weekly applications of a spray of 1 oz. liver of sulphur [potassium sulphide] and 3 oz. soft soap in 3 gals. water. Other pests observed during the year included *Periplaneta americana*, L., which damaged the cotyledons of annual seedlings under glass in October, *Empoasca fabae*, Harr., and *Taeniothrips simplex*, Morison (*gladioli*, Mlt., & Stnw.), both of which caused considerable injury to *Gladiolus*, *Phylloxera vitifoliae*, Fitch, on an isolated grape-vine, which was destroyed, and *Ceratitis capitata*, Wied., on the fruit of a neglected papaya.

Injurious insects intercepted on imported plants included *Anastrepha fraterculus* var. *mombinpraeoptans*, Seín, in mangos from the British West Indies, *Otiorrhynchus sulcatus*, F., on *Cestrum aurantiacum* from England, and *Pyrausta nubilalis*, Hb., on raw maize cobs from the United States. Reference is made to observations showing the risk of the introduction of adults of *Popillia japonica*, Newm., on boats from the United States [**27** 85].

Busck (A.). **Un lepidóptero nuevo que perjudica el níspero en la Argentina. (Familia Gelechiidae.)** [A new Moth injurious to Loquat in Argentina.]—*An. Soc. cient. argent.* **127** pt. 5 pp. 361–365, 3 figs. Buenos Aires, 1939. (With a Summary in English.)

Descriptions are given of both sexes of *Proclesis eriobotryae*, sp. n., the larvae of which were observed feeding in the fruits of loquat (*Eriobotrya japonica*) in the province of Tucumán, Argentina, in 1938.

Meyrick (E.). **New Microlepidoptera, with Notes on Others.**—*Trans. R. ent. Soc. Lond.* **89** pt. 4 pp. 47–62. London, 1939.

This posthumous paper was communicated by T. B. Fletcher. The new species described include *Euzophera amphimetra*, *Blastobasis atmozona*, *Recurvaria synestia* and *Phthorimaea vorax*, all predacious on Coccids in Argentina ; *Chelaria anthotypa*, feeding on leaves of *Derris elliptica* and in fruits of *Glochinia* in Java ; and *Leucoptera hyperophrys*, mining leaves of *D. elliptica*, and *Tinea nucivora*, feeding on copra dust, both in Malaya.

Notes are given on a number of other species, including *Eucosma nereidopa*, Meyr., of which *E. phylloscia*, Meyr. [*R.A.E.* A **26** 151]

is stated to be a synonym, and *Cydia* (*Laspeyresia*) *cymbalora*, Meyr., which is recorded as attacking leaves of *D. elliptica* in Java but is stated by Fletcher to be synonymous with *C.* (*L.*) *novarana*, Felder.

GREAVES (T.). **The Control of Meat Ants** (*Iridomyrmex detectus* **Sm.**).—*J. Coun. sci. industr. Res. Aust.* **12** no. 2 pp. 109–114, 2 refs. Melbourne, 1939.

*Iridomyrmex detectus*, F. Sm., an indigenous species, is probably the most abundant and widely distributed ant in Australia. It is not a pest of great economic importance, but builds unsightly nests, damages the blossom of fruit trees, protects insects that produce honey-dew, and may occasionally infest dustbins and stored food. It has also attacked mound-colonies of *Eutermes exitiosus*, Hill, employed in tests of timbers and timber preservatives at Canberra, but injury was practically confined to colonies from which the natural food had been removed. It is not doubted that a healthy colony of termites could withstand attack indefinitely. The nests of *I. detectus* vary from a few subterranean galleries with one or two entrances to an extensive system surmounted by a low mound with numerous entrances. An average mound is 4–6 ft. in diameter and 4–6 ins. high and has 20–30 openings. Investigations on the cause of repopulation of treated nests showed that the nests often form groups between which regular communication is maintained. It is not known whether a colony may have more than one queen, or if so, whether they are confined to one nest.

Control experiments involving over 300 nests were carried out in 1934–36. Of the 9 substances used, carbon bisulphide and calcium cyanide were outstanding and are dealt with in detail, Paris green and calcium arsenate at rates of 1–3 oz. per nest were sometimes successful, while the remainder, which included paradichlorobenzene, were unsatisfactory [*cf. R.A.E.*, A **17** 354; **23** 398]. To fumigate with carbon bisulphide, the liquid is poured at the rate of 1 pint for a nest 4–6 ft. in diameter, or ½ pint for a smaller nest, into a vertical hole 9–12 ins. deep in the middle of the mound, which is then filled with earth. Treatment should be made in the early morning or in the heat of the day when the ants are in the nest. With calcium cyanide, it is not necessary to take this precaution, but the air and soil should be dry. The Cyanogas forms of this fumigant were used, and better results were obtained with the granules than with the powder. They should be introduced at the rate of 1–4 oz. per nest into all the entrance holes, which should then be plugged. To ensure the destruction of the reproductive centre of a colony, all the nests in a group must be treated and to this end should be located by tracing the connecting paths on a warm dull day when the ants are active above ground.

MUGGERIDGE (J.). **Parasitic Control of Pests. Experiments with White Butterfly and Diamond Back Moth.**—*N.Z. J. Agric.* **58** no. 4 pp. 305–307, 1 fig. Wellington, N.Z., 1939.

Biological control by *Pteromalus puparum*, L., of *Pieris rapae*, L., on cruciferous crops in New Zealand, supplemented when necessary by dusting, is now sufficiently successful, in spite of occasional outbreaks [*cf. R.A.E.*, A **25** 80], and the rearing of the Pteromalid is therefore to be discontinued. A single species of parasite is unlikely to give complete control under the wide range of climatic conditions to be found throughout New Zealand, but attempts in 1932–34 to introduce the

larval parasite, *Apanteles glomeratus*, L., from England [**22** 724 ; **24** 3 ; etc.] were unsuccessful. The author found that *A. rubecula*, Marsh., and *A. glomeratus* were both common in Europe in 1938, and considers that the former may be of greater importance in controlling *P. rapae* than is generally believed, whereas the value of the latter may be less, since it also attacks the large white butterfly [*Pieris brassicae*, L.], which is absent from New Zealand. In view of these facts, a further attempt to establish *A. glomeratus* is being made with material imported from the United States, where *P. brassicae* is also absent and the degree of parasitism of *P. rapae* by *A. glomeratus* is high.

The diamond back moth [*Plutella maculipennis*, Curt.], which is a serious pest of cruciferous crops in New Zealand [**19** 141], is scarce in Europe, where, however, it is parasitised to a high degree, and the author suggests that this may be due to its parasites' having alternate hosts. The Ichneumonid, *Angitia cerophaga*, Grav., which was introduced into New Zealand against it during 1937–38 [*cf.* **27** 262], is established and was recovered from three northern districts in the South Island during the season of 1938–39, but it was itself attacked by a native parasite that may reduce its effectiveness. The Ichneumonid, *Thyraeella* (*Diadromus*) *collaris*, Grav., which parasitises the pupa of *P. maculipennis* and has recently been introduced into New Zealand, is being reared in large numbers in field cages, and has been liberated in a locality in Hawke's Bay, where it is apparently becoming established.

Murray (J. M.). **An Investigation of the Inter-relationships of the Vegetation, Soils and Termites.**—*S. Afr. J. Sci.* **35** pp. 288–297, 2 graphs. Johannesburg, 1938. [Recd. 1939.]

In this account of the results of investigations into the inter-relationships between vegetation, soils and termites in the Transvaal, the author discusses the nest structures, habits and fungus and animal associates of twelve species of termites, the composition of soils in two different types of veldt and in termitaria, and the association of the vegetation with termites. As regards the detrimental effects of their presence, she concludes that both subterranean termitaria and termite mounds occupy a considerable area, which must have some significance. Termites in some way convert the fertile surrounding soils into the sterile soil of which their termitaria are composed and on which very few plants can grow. In addition to the direct loss caused by their attacks on vegetation, which frequently kill the plants, their harvesting habits reduce the grazing value of the veldt and encourage soil erosion [*R.A.E.*, A **23** 377]. Beneficial effects resulting from termite activities include increased aeration of the soil and, when the colonies die out, formation of highly fertile soils by the oxidation and disintegration of the termitaria.

Kennedy (J. S.). **The Behaviour of the Desert Locust** (*Schistocerca gregaria* (**Forsk.**)) **(Orthopt.) in an Outbreak Centre.**—*Trans. R. ent. Soc. Lond.* **89** pt. 10 pp. 385–542, 9 pls., 37 figs., 6 pp. refs. London, 1939.

To determine the rôle of behaviour in the process of phase transformation in locusts, field observations and experiments were carried out from December 1936 to April 1937 on *Schistocerca gregaria*, Forsk., in an outbreak centre at Hamashiameb, on the Red Sea coast

of the Anglo-Egyptian Sudan. The technique adopted for observations on microclimate and the experimental methods used in the field and in camp cages are described in detail, and a complete and critical survey is given of the literature on various aspects of locust behaviour and the development of outbreaks. No outbreak occurred during the 1936–37 season, and the indigenous population of phase *solitaria* passed through only one generation, new adults disappearing, perhaps by emigration, in February. The area was invaded by three successive immigrant swarms. The offspring of individuals of the second invasion were biometrically near to phase *gregaria*, and those that did not march away repopulated the cultivated areas with individuals of phase *dissocians*. The first immigrant swarm, despite gregarious behaviour and coloration, was biometrically nearer to phase *solitaria* than the indigenous population.

The soils, climatic conditions and vegetation of Hamashiameb are described [*cf. R.A.E.*, A **24** 231]. The area consists in a silt plain and soft, shifting sand dunes. There is little vegetation other than bushes of *Suaeda fructicosa* during the rainless summer. With the winter rains, during which parts of the area are flooded for a short period, *Panicum turgidum* and *Cyperus* spp. appear, and bulrush millet (*Pennisetum typhoideum*), which is almost the only crop, is sown. With it, spring up annual grasses, *Heliotropium pallens* and *H. undulatum*. The vegetation is most luxuriant in late December and early January, but later the open plain begins to dry up and the vegetation gradually dies. Sand dunes that have been flooded remain moist longest, and millet planted in the coarse silt between them remains green in patches until April.

The events leading to an outbreak are divided into three stages, which are shown to be practically, as well as theoretically, distinct. The first stage is designated " concentration," or absolute increase in population density in a restricted area. To elucidate the factors leading to it, observations were made on the distribution of hatching sites, the food-preferences of hoppers and adults, the rates of wandering of hoppers in stands of vegetation of different densities and the visual attraction of locusts to conspicuous vegetation. It was found that the distribution of hatching sites is limited because the adults of the previous generation oviposit in the course of the winter floods near areas cultivated in the previous year, mostly among marginal dunes, where the drying surface sand is repeatedly removed by wind. Food-preferences do not determine the distribution of hoppers. Newly hatched individuals remain on the first vegetation encountered, mats of *H. undulatum* on the dunes, and grass or *H. pallens* elsewhere. Their mobility increases with age, and the older hoppers wander at rates varying inversely with the density of the vegetation. Lack of vegetation cover and wind stimulate wandering, and a distance of 110 yards is covered in a day by older hoppers on the bare plain. Visual attraction is an efficient means of gathering hoppers into higher and more conspicuous vegetation, from distances up to 11 yards, and prevents them from leaving it. As a result of their higher rate of wandering and greater response to visual attraction, the older hoppers become concentrated in plots of tall-growing millet, with irregular undergrowth, which constitute the commonest type of concentration zone on the Red Sea coast of the Sudan.

The behaviour of adults was studied in individuals of phase *dissocians*. In their case, again, food-preferences do not determine

distribution or concentration. Young adults at first scatter throughout millet, regardless of the density of undergrowth. Their normal range of movement is less than that of the older hoppers, since the rate at which they move is very little affected by variations in the density of the surrounding vegetation. Their range, however, is extended by short flights, which are either due to disturbances, or, more rarely, spontaneous. They respond to visual attraction by conspicuous vegetation, which explains their continual concentration in millet, and enables them to reach it from other zones, so that the concentration achieved by hoppers is maintained and even increased.

This type of concentration, which involves the active movement of individuals, is termed " real concentration." The degree of concentration achieved by the first generation, however, is inadequate to cause an outbreak, for which " virtual concentration," produced by a local increase in population density, is essential. This occurs when a second generation, depending on ample and prolonged winter rains, makes its appearance [*cf. loc. cit.*], for its members start life in the concentration zones and remain trapped in them.

The second stage is " aggregation." During the first three instars, hoppers remain mostly in the undergrowth, but older ones show a well-defined diurnal routine comprising vertical and horizontal movements and basking in aggregated groups on bare ground. This routine is especially pronounced in zones in which shelter from the wind is provided by high and continuous vegetation, such as millet. Together with observations on the movements of phases *solitaria* and *dissocians* in unweeded millet, continuous records were made of temperatures, with parallel measurements of body temperatures in a number of representative positions at different levels from the ground. Corresponding records were made of atmospheric humidity, light intensity and wind velocities. Field observations were supplemented by cage experiments on reactions to light, gravity and temperature. It is tentatively concluded that the different phases of behaviour are to be attributed to a continual interplay of external factors, such as wind, light, and, especially, gravity and temperature ; there appears to be little correlation between behaviour and humidity. The beginning and ending of activity are apparently determined by changes in the intensity of light as well as in temperature. The morning ascent is due to negative geotaxis, and the increasing activity accompanying it must be attributed to increasing illumination and rising temperature (positive thermokinesis). As activity is further increased by the latter factor, there is a general descent to the ground, which is assisted by the effects of rising wind. With small patches of bare ground becoming the warmest positions, temperature reactions override all others, and hoppers collect on these patches as a result of negative thermokinesis. When, at mid-day, the temperature of basking places reaches a point at which strong positive thermokinesis supervenes, the hoppers move to cooler places, but in the afternoon, as soon as the temperature decreases and the warmest positions are no longer avoided, basking and group formation start again. In this way, reactions to temperature cause the majority of the hoppers to spend most of the day on small bare patches, on which groups are formed as a result of the separate reactions of individuals and the restricted space available for basking in relation to the number of hoppers in the vicinity. This produces " aggregation," or the grouping of individuals in contact with each other, so that they assume an increasingly

important part in each other's sensory experience, and the principal factor leading to it is the patchy nature of the temperature field within the concentration zones. In the evening, the groups break up when the basking places become shaded, and the evening ascent on plants is determined mainly by negative geotaxis and positive phototaxis. The adults follow the same daily routine as the older hoppers, but as they make short flights, groups are smaller, and there is a reduction of aggregation in the adult stage.

The third stage is " gregarisation " or change of phase. This did not occur in Hamashiameb, and the conclusions are based on a comparison of the observed behaviour of phases *solitaria*, *gregaria* and *dissocians*. Hoppers of phase *gregaria* differ from those of phase *solitaria* in their " hypermetabolism " *i.e.*, higher rate of metabolism, and greater excitability and activity, their greater activity due to mutual stimulation, particularly visual, and their tendency to move together in the same direction, due to discriminating visual " compensation reaction " to their fellows, which enables the bands to preserve formation in rest or movement and constitutes the " gregarious instinct " proper. In the phase cycle, this " instinct " develops before the changes in activity level, which lag behind it just as the biometrical changes lag behind those of colour and behaviour. It develops in aggregated groups, in which the hoppers are forced to move simultaneously for a few minutes when disturbed. During the early months of the rainy season, when the first generation is produced at Hamashiameb, the weather is cloudy and cool, quiescent basking is prolonged, and when hoppers move away the undergrowth separates them at once, so that the " gregarious instinct " cannot develop to any degree. When a second generation is produced, population density and mutual stimulation would be greater and the crowding further increased by seasonal drying up of vegetation. Moreover, basking groups of hoppers and adults would be more frequently stimulated by high mid-day temperatures and disturbances by men and cattle to simultaneous movements, favouring the development of the " gregarious instinct " prior to " hypermetabolism." When this process reaches a point at which the " gregarious instinct " is sufficiently strong to prevent scattering, an outbreak will occur, for the locusts will then be able to leave cultivated areas, since they become formed into marching bands or flying swarms in which visual attraction to millet is overridden by mutual attraction and stimulation.

It is possible that the coastal outbreak centres in the Anglo-Egyptian Sudan do not constitute a complete outbreak area, but are part of a larger complex, between sections of which migrations of phase *solitaria* occur [*cf.* **24** 443 ; **25** 161]. It is suggested that hoppers within these outbreak centres can be controlled by removing all the undergrowth from the concentration zones, except on areas 4–5 yards in diameter and not more than 110 yds. apart. Each of these should contain several patches of bare ground 16–20 ins. in diameter. These unweeded patches would serve as traps for the hoppers, which could then be easily poisoned.

**Insect Pests of the Cucurbits.**—*Palestine Gaz.* May 1939, *Agric. Suppl.* no. 41 pp. 96–99. [Jerusalem] 1939.

In Palestine, the adults of the red melon beetle [*Rhaphidopalpa foveicollis*, Lucas], which has 2–4 generations a year on cultivated

plants, emerge from their hibernation quarters under débris in late March or early April and feed voraciously on cucurbit seedlings, sometimes destroying a whole planting. On old plants, the flowers are also attacked. Eggs are laid singly near the surface of the soil under the plants, and the larvae bore into the root-collar. Groups of 8–12 are found with the head buried in the tissue and the rest of the body outside. As a result, the plant is weakened, exposed to fungous diseases and usually dies. Melons are the favourite food-plants, and it is suggested that they should be sown as a trap crop among cucumbers or other cucurbits. The adults may be controlled in April–June by 2 or 3 applications of a derris dust containing 0·75 per cent. rotenone [*cf. R.A.E.*, A **26** 371].

Most of the overwintered adults of the twelve-spotted ladybird [*Epilachna chrysomelina*, F.] emerge from hibernation during May. Damage is great between May and July on the plains, especially the Jordan valley and coastal plains, but neither this species nor *R. foveicollis* is a serious pest in the hills, where the temperatures are not sufficiently high. Eggs are laid in clusters of 50 or less on the lower surfaces of the leaves of cucurbits, and hatch in 3–5 days. The larvae begin to feed at once, making rows of transparent spots on the leaves. They moult 3–5 times and pupate on plants, tree trunks, etc. There are 5 generations annually. The adults cease activity at the beginning of the rainy season. The larvae are easily controlled by barium fluosilicate or sodium fluosilicate and the adults by derris dusts. A dust containing equal parts of either fluosilicate and a derris dust of such strength that the mixture contains 0·75 per cent. rotenone is recommended to protect crops against *R. foveicollis* and larvae and adults of *E. chrysomelina*.

The melon fruit-fly [*Myiopardalis pardalina*, Big.] has recently become established [**26** 77] in the coastal plain and on the slopes of the hills, and it now makes the growing of melons almost impossible. The number of generations a year has not been ascertained, but the first adults appear and deposit eggs under the skin of the fruit in early May. The larvae make tunnels in the fruit and a fungus associated with them causes it to decay. Up to 60 per cent. of the fruits of watermelon and 85–90 per cent. of those of sweet melons and musk melons are destroyed. Excellent results were obtained experimentally in 1938 with bait-sprays of 100 parts sugar to 1,000 parts water by weight with the addition of 3 parts sodium fluosilicate or 8 parts copper carbonate, applied weekly from the appearance of the flies to the end of the cropping season.

Whiteflies [*Trialeurodes vaporariorum*, Westw.] appear singly in May, but from the beginning of August to the end of October they cover the lower surfaces of the leaves of cucurbits and other plants, causing them to wilt. A generation is completed in 30–40 days. In preliminary trials, good control was obtained by spraying with nicotine sulphate (1 : 500) in a 1 per cent. white oil emulsion, but the plants were rapidly reinfested from untreated wild plants.

GARCIA (C. E.). **The Citrus Rind Borer and its Control.**—*Philipp. J. Agric.* **10** no. 1 pp. 89–92, 2 pls. Manila, 1939.

An account is given of the bionomics of *Prays citri*, Mill., the larvae of which bore under the skin of fruits of sweet orange, grapefruit, lemon, lime and wild *Citrus* in the Philippines [*R.A.E.*, A **12** 270], and all

stages of this Tineid are briefly described. The egg, larval and pupal stages are here stated to last 4–5, 10–19 and 3–5 days, respectively. Young fruits are infested after the petals of the flowers wither, and many of them drop before they are more than 10 mm. in diameter. Commercial varieties of *Citrus* do not bear flowers or fruit during January–March, and the insect then breeds on continuously bearing wild varieties of *Citrus*, returning to the cultivated varieties when these begin to flower.

In experiments on control, promising results have been given by a spray of 120 gm. derris powder and 300 gm. soap in 5 U.S. gals. water [**25** 792], which is stated to kill both eggs and pupae with which it comes in contact, applied weekly from petal fall until the fruits have reached a diameter of rather less than 1 in., or, in the case of grapefruit, of about 3 ins. The adults can be killed by means of a bait-spray of 20–25 gm. sodium arsenite and 400–500 gm. brown sugar in 5 U.S. gals. water, applied to the foliage in the evening at weekly intervals during the same period. Fallen fruits should be collected, before the larvae leave them to pupate in the grass and weeds, and destroyed by deep burying, or immersed in strong soap solution for two days. It has been found that the larvae fail to complete their development in the fruits of certain species of *Citrus* (Villafranca lemon, calamondin and Tahiti lime) on which the moths oviposit readily, and it is suggested that these should be grown as trap crops.

The pupae are attacked by a Hymenopterous parasite, and the ant, *Oecophylla smaragdina*, F., prevents infestation of fruits on trees in which it has made its nests.

Pruthi (H. S.) & Samuel (C. K.). **Entomological Investigations on the Leaf-curl Disease of Tobacco in northern India. III. The Transmission of Leaf-curl by White-fly, *Bemisia gossypiperda*, to Tobacco, Sann-hemp and a new alternate Host of the Leaf-curl Virus.**—*Indian J. agric. Sci.* **9** pt. 2 pp. 223–275, 4 pls. (3 col.), 1 fig., 20 refs. Delhi, 1939.

A full account is given of experiments, the results of which have already been noticed [*R.A.E.*, A **26** 242; **28** 2] on the transmission of the various types of leaf-curl affecting tobacco, sunn hemp [*Crotalaria juncea*] and *Ageratum conyzoides* in northern Bihar by the Aleurodid, *Bemisia gossypiperda*, Misra & Lamba.

Pruthi (H. S.) & Batra (H. N.). **The Phytophagous Chalcidoid, *Eurytoma samsonovi* Vas., a serious Pest of Apricot and some other Fruits in India.**—*Indian J. agric. Sci.* **9** pt. 2 pp. 277–283, 1 col. pl., 22 refs. Delhi, 1939.

Apricots infested with insect pests in the North-West Frontier Province in 1910 and 1911 were found in the latter year to contain Eurytomid larvae. These were thought to be parasitic on the pest, but during further examinations in 1915-16 and 1926-27, only the Eurytomid emerged, and subsequent biological investigations showed that it was a phytophagous species, which was identified as *Eurytoma samsonovi*, Vass. [*R.A.E.*, A **20** 307]. Apart from the fig-insects, this species and *Bruchophagus mellipes*, Gah., which infests *Sesbania* [*cf.* **8** 19], are the only phytophagous Chalcidoids known from India; a list is given of the phytophagous species of *Eurytoma* and *Bruchophagus* that occur in other countries.

In the plains of the North-West Frontier Province, the adults of *E. samsonovi* appear in the orchards during the second half of March, while at the higher altitudes, emergence is delayed until the middle of April. At Haripur, adults emerged on 20th March 1938, pairing was observed at the end of the month, and larvae 4–5 days old were found feeding in apricots about 20th April. The eggs, which have not yet been observed, are apparently laid on the endocarp or inside the young seeds of the apricots. The larvae feed on the kernel, causing the fruit to shrivel and fall. They are full-fed in September or October and pupate about the end of February [*cf.* **28** 2]. Sometimes the larval stage is prolonged through the following summer and winter. The young and mature larvae and pupae and adults of both sexes are described. In addition to apricot, peach and plum are attacked to some extent. Though widely distributed in the North-West Frontier Province, this Eurytomid causes serious damage in the plains only. In Hazara, where attack is especially severe, as much as 70 per cent. of the apricot crop is lost. The earliest variety is the most severely attacked, and the latest and most choice the least so, only 10–20 per cent. of the fruits being infested. Collecting and burning fallen fruits has been found a very effective method of control. No parasites have been observed.

[Konakov (N. N.).] **Конаков (Н. Н.). Methods and Technique of the quantitative Determination in the Fauna of the terrestrial Invertebrate of the Grass Cover.** [*In Russian.*]—*Probl. Ecol. Biocenol.* no. 4 pp. 5–25, 8 figs., 23 refs. Moscow [1939]. (With a Summary in English.)

Brief descriptions are given of ten types of apparatus, most of which were devised in the Russian Union, for estimating the numbers of insects occurring on soil and low-growing plants [*cf. R.A.E.*, A **14** 607; **25** 397]. The author considers all the existing methods of estimating the insect population unsatisfactory, as each has disadvantages and all are laborious.

Chesnokov (P. G.). [**Чесноков (П. Г.).**] **Relationship between Distribution of various Wheat Forms and their Resistance to Attacks of Frit-fly (*Oscinella frit* L.).** [*In English.*]—*C.R. Acad. Sci. URSS* **22** no. 5 pp. 282–286. Moscow, 1939.

From data obtained in the course of three years in the Province of Leningrad on the resistance of different species and varieties of wheat to attack by *Oscinella frit*, L., it is shown that there exists a definite relation between the geographical origin of the wheat and its susceptibility to injury. Forms of wheat species that have a small area of distribution differed little in their resistance, whereas those of the widely distributed species differed greatly. Forms from a given locality exhibited a difference in resistance proportionate to the diversity in the agro-ecological conditions there. Within an individual species of wheat, the resistance of the forms was related to the biological peculiarities acquired through growing in a definite medium or through selection.

Evidence was obtained that the ecotype to which the given form of wheat belongs essentially determines the degree of infestation by the

frit-fly as well as the degree of resistance of the plants to injury. It was also found that the susceptibility of the same form of wheat may vary considerably under different environmental conditions. The susceptibility of different forms and groups of wheat varied with the geographical zone in which the wheat was cultivated; thus, hard wheats from Syria, which proved to be only slightly susceptible in Leningrad Province, were severely affected in North Caucasus, and hard wheats from the steppe zone were far less injured in the latter Province than in Leningrad.

Chesnokov (P. G.). [Чесноков (П. Г.).] **Geographic Variation of Wheats in their Resistance to Hessian Fly** (*Phytophaga destructor* **Say).** [*In English.*]—*C.R. Acad. Sci. URSS* **23** no. 3 pp. 287–291, 1 map, 1 fig., 3 refs. Moscow, 1939.

The results are summarised of three years' work in the northern Caucasus on the susceptibility of species and varieties of wheat from many parts of the world to infestation by *Mayetiola* (*Phytophaga*) *destructor*, Say. The distribution of the principal species of wheat and the degree to which they are susceptible to infestation, expressed as the percentage of plants injured and the numbers of cocoons found per 100 plants, are shown in a table. Resistance to injury was found to be related to the geographical origin and ecological group of the form concerned, and not to morphological characters. It is possibly due to a complex of factors including the latter, bio-chemical peculiarities and the rate of growth and development.

It was shown in the course of the work that examples of *M. destructor* from northern Russia (Province of Leningrad) readily attacked varieties of wheat that were not infested by individuals from Kuban (northern Caucasus).

Ralski (E.). **Ochrona roślin na Śląsku.** [Plant Protection in Silesia.]—*Roczn. Ochr. Rośl.* **6** fasc. 2 pp. 5–15. Puławy, 1939. (With a Summary in German, p. 36.)

Ralski (E.) & Pill (R.). **Ochrona roślin na Śląsku Zaolziańskim.** [Plant Protection in Silesia beyond the River Olza (Districts of Cieszyń and Frysztat).]—*T.c.* pp. 31–35.

These papers were read during the fifth summer meeting of the Service of Plant Protection in Poland, held in the Province of Silesia in July 1938. They contain a survey of the organisation of plant protection in that area, with brief records of the pests and diseases of crops and fruit trees.

Kawecki (Z.). **Szkodniki drzew i krzewów owocowych z pośród czerwców.** [Coccid Pests of Fruit Trees and Bushes.]—*Roczn. Ochr. Rośl.* **6** fasc. 2 pp. 41–54, 12 figs., 13 refs. Puławy, 1939.

An account is given of the biology of Coccids in general, together with notes on the life-history of the 9 species that are common on fruit trees in Poland. In some cases, control measures are recommended.

Prüffer (J.). **Dalsze badania nad zjawiskiem wabienia samców u *Lymantria dispar* L.** [Further Investigations on the Phenomenon of alluring the Males of *L. dispar*.]—*Zoologica Poloniae* **2** fasc. 1, 1937. (Abstr. in *Roczn. Ochr. Rośl.* **6** fasc. 2 pp. 92–93, Puławy, 1939.)

During investigations carried out in north-eastern Poland in 1932–35 on the use of the scent of females of *Lymantria dispar*, L., for trapping the males, an extract of the abdominal segments prepared with 85 per cent. alcohol was filtered through cotton-wool and preserved in closely stoppered glass flasks [*cf. R.A.E.*, A **21** 459; **23** 668; **26** 665]. Wads of cotton-wool moistened with this extract were found to attract the males, though they were much less attractive than normal females. They were, however, more attractive than pieces of the cotton-wool through which the extract had been filtered. The attractiveness of the extract was reduced, but not lost, after storage for 3 years [*cf.* **21** 459]. Extracts prepared from 100, 50 or 20 abdominal segments attracted approximately equal numbers of males; those prepared from 10 or 2 segments were markedly less effective. It was found that 20 cc. 85 per cent. alcohol extracted the attractant from 20 abdominal segments.

The males were most attracted by unpaired females not more than 2 days old. Those that had recently paired but had not oviposited were less attractive, and the least so were those that had laid eggs, irrespective of whether they had paired or not. The most effective of the various extracts tested were those prepared from females that had not paired or oviposited.

Szymański (W.). **Przyczynek do analizy karbolineum sadowniczego.** [Contribution to the Analysis of Fruit-tree Carbolineums.]—*Roczn. Ochr. Rośl.* **6** no. 3 pp. 9–13, 2 refs. Puławy, 1939. **Chemiczna analiza karbolineum sadowniczego.** [Chemical Analysis of Fruit-tree Carbolineums.]—*T.c.* pp. 14–19, 4 refs.

In these papers, details are given of methods for the analysis of tar-distillate emulsions, including modifications of those proposed by Hilgendorff in a paper already noticed [*cf. R.A.E.*, A **25** 120] and the author's method of testing the uniformity of the fluids [**26** 300].

Strawiński (K.). **Krytyczny przegląd owadów z rzędu *Hemiptera-Heteroptera* (pluskwiaki różnoskrzydłe) zarejestrowanych przez zakłady ochrony roślin w Polsce w latach 1919–1933.** [A critical Survey of Insects of the Order Hemiptera-Heteroptera recorded by the Institutions of Plant Protection in Poland in the Years 1919–1933.]—*Roczn. Ochr. Rośl.* **6** no. 3 pp. 20–50, 32 refs. Puławy, 1939. (With a Summary in German.)

This survey is based on the literature and on personal observations and deals with species of Heteroptera found on plants in Poland during 1919–33. They are arranged under their families, and notes are given on their distribution, food-plants and economic importance in Poland, and in some cases also in other countries. The species stated to be of importance as pests are: *Aradus cinnamomeus*, Panz., on pines, particularly *Pinus sylvestris* [*cf. R.A.E.*, A **13** 375]; *Piesma quadratum*, Fieb., on beet [*cf.* **27** 350]; *Lygus pabulinus*, L., *L. pratensis*, L., and *Dolycoris baccarum*, L., which attack a great variety of plants; *Notostira*

*erratica*, L., *Trigonotylus ruficornis*, Geoffr., *Eurygaster maura*, L., and *Aelia acuminata*, L., on cereals; and *Eurydema ornatum*, L., and *E. oleraceum*, L., on crucifers. *Troilus luridus*, F., *Picromerus bidens*, L., *Anthocoris nemorum*, L., and *Nabis* spp. are predacious on other insects.

PRÜFFER (J.). **Wyniki ośmioletnich obserwacyj nad rójkami chrabąszczy w Polsce.** [Results of eight Years' Observations on the Flights of Cockchafers in Poland.]—*Roczn. Ochr. Rośl.* **6** no. 3 pp. 55–70, 4 refs. Puławy, 1939. (With a Summary in German.)

Notes are given on the distribution and abundance of the swarms of *Melolontha melolontha*, L., in different localities in Poland in 1938, followed by a survey of the occurrence of flights of this species and of *M. hippocastani*, F., in various parts of the country since 1931 [*cf. R.A.E.*, A **27** 676, etc.].

SIEMASZKO (W.). **Zespoły grzybów towarzyszących kornikom polskim.** [Fungi associated with Bark-beetles in Poland.]—*Planta polon.* **7** no. 3, 54 pp., 5 pl., 3 figs. Warsaw, 1939. (With a Summary in English.) (Abstr. in *Rev. appl. Myc.* **18** pt. 7 p. 488. Kew, Surrey, 1939.)

The author studied the association of fungi with bark-beetles in material collected in 1933–37 in different parts of Poland. Constant association was observed of *Ophiostoma* (*Ceratostomella*) *penicillatum*, *O. polonicum*, sp. n., and *Graphium pycnocephalum* with *Ips typographus*, L., on spruce, *Picea abies* (*excelsa*); of *O.* (*C.*) *pini* and *O.* (*C.*) *ips* with *I. sexdentatus*, Börn., and *O. pini* with *Myelophilus piniperda*, L., both on pine, *Pinus sylvestris*; and of *O.* (*Graphium*) *ulmi* with *Scolytus scolytus*, F., and *S. multistriatus*, Marsh., on elm, *Ulmus foliacea*. In addition to these blue-staining fungi, Saccharomycetaceae were constantly associated with all these Scolytids except *M. piniperda*, and the intensely brown-staining fungus, *Stysanus ulmi*, sp. n., was an occasional associate of *S. scolytus* and *S. multistriatus*. Descriptions of these fungi are given and of many others occasionally associated with the beetles, as well as Latin diagnoses of the new species.

BARANOV (N.). **Let druge generacije maslinovog moljca u godini 1938.** [The Flight of the second Generation of the Olive Moth in the Year 1938.]—*Arh. Min. Pol'oprivr.* **6** no. 15 pp. 124–129, 1 graph, 7 refs. Belgrade, 1939. (With a Summary in German.)

Observations in 1937–39 showed that *Prays oleellus*, F., has three generations a year on olives near Dubrovnik in Dalmatia, and that its bionomics are largely similar to those recorded from western Transcaucasia [*cf. R.A.E.*, A **18** 154]. The larvae of the overwintering generation, however, abandoned their galleries in the leaves at the end of November and migrated to the trunk or to the soil. Larval development was interrupted from December to February in 1937–38, but only until mid-January in 1938–39. The larvae reinfested the leaves after this period and continued to mine in them until March 1938, when they left their mines and fed on the lower surfaces of the leaves

beneath webs and also attacked young leaves at the tips of the twigs. Pupation occurred at the end of March and in the first ten days of April, chiefly on the lower surfaces of the leaves, and, much more rarely, in the soil. The adults were on the wing from 10th April till about 20th May. The larvae of the second generation, which feed on the fruits, pupated in August and the first half of September on the leaves, or in the soil if the fruits had fallen.

Observations in 1938 on the adults of the first generation showed that the numbers on the wing depend on the temperature of the air in the evening. The moths were caught by means of a bait renewed every 4–5 days and containing 0·3 per cent. sodium arsenite in a 10 per cent. solution of sugar-beet molasses, which was exposed on olive trees in vessels of 1 litre capacity filled three-quarters full. The first moths were taken on 23rd June, when the temperature reached 25°C. [77°F.], and the last on 13th July, when it fell to 22°C. [71·6°F.]. The peak of the flight lasted from 24th to 28th June. Of 619 moths taken in four traps, 66 per cent. were females.

Department of Scientific & Industrial Research. Forest Products Research. **A Handbook of Home-grown Timbers.**—2nd Edn., med. 8vo, vi+87 pp. London, H.M.S.O., 1939. Price 2s.

Cox (H. A.) Ed. **A Handbook of Empire Timbers.**—Med. 8vo, vii+214 pp. London, H.M.S.O., 1939. Price 3*s.* 6*d.*

These handbooks deal with timbers of trees grown in Britain and the British Empire, respectively, and are arranged on identical lines. The first of them is the second edition of one already noticed [*R.A.E.*, A **25** 207]; the number of trees dealt with has been increased, and the text has been considerably expanded. They contain general descriptions of a large number of trees and of the timber of each, with brief notes on its properties and uses, and, in cases in which such data are available, the readiness with which it is penetrated by liquids used for preservative treatment, and its liability to attack by insects and wood-destroying fungi.

Staniland (L. N.) & Beaumont (A.). **Department of Plant Pathology. Fifteenth Annual Report for the Year ending September 30th, 1938.**—*Pamphl. Seale-Hayne agric. Coll.* no. 49, 39 pp. Newton Abbot, Devon, 1939.

Pests that caused considerable damage in Devon and Cornwall during the year ending 30th September 1938, in addition to some of those noticed from the two previous years' reports [*R.A.E.*, A **25** 523; **26** 527], included *Sitona* (*Sitones*) spp. on peas and beans; *Brevicoryne brassicae*, L., *Hylemyia* (*Chortophila*) *brassicae*, Bch., *Pieris* spp. and *Aleurodes brassicae*, Wlk., on cruciferous vegetables; *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) and *M. ribicola*, Kalt. (*Myzus lactucae*, Schr.), on lettuce; *Psila rosae*, F., on carrots; *Trialeurodes* (*Aleurodes*) *vaporariorum*, Westw., and *Tetranychus telarius*, L., on tomatos and cucumbers and the latter also on peaches under glass; *Anuraphis padi*, L., and *Hyalopterus arundinis*, F., on plum; *Contarinia pyrivora*, Ril., on pear; *Bryobia praetiosa*, Koch (*nobilis*, Koch), on gooseberry; *Capitophorus ribis*, L., on black

currants ; *C. fragariae*, Theo., on strawberry ; *Tarsonemus approximatus* var. *narcissi*, Ewing, on *Narcissus* bulbs ; *Myzus ornatus*, Laing, on anemone and violet, and *Phyllotreta* spp. on wallflowers. During 1937, it was found that the woolly aphis [*Eriosoma lanigerum*, Hsm.] had not been prevalent on apple for several years at centres in which its parasite, *Aphelinus mali*, Hald., had previously been colonised, though the initial results of the liberations had not been promising. Liberations on a larger scale have therefore been made.

The survey of the distribution of *M. persicae*, Sulz., on potato [**26** 527] was continued. The Aphid was more prevalent than during the previous year, and many areas in which infestation was then moderate are no longer considered satisfactory seed-producing centres. However, areas that were free from infestation or lightly infested in 1937 remained so. The importance of growing seed potatoes in places remote from broccoli was shown. Notes are given on the abundance of other species of Aphids on potato as compared with the previous year. They all occurred at centres that were free from *M. persicae*. Investigations by K. M. Smith indicated that *M. ornatus* is not capable of transmitting virus.

Arthropods not recorded in previous annual reports and those occurring on food-plants not previously recorded included *Linopodes* sp. on mushroom and *Contarinia nasturtii*, Kieff., on savoy cabbage and broccoli, 90 per cent. of early varieties of which were sometimes attacked.

BRINDLEY (M. D.). **Observations on the Life-history of *Euphorus pallipes* (Curtis) (Hym : Braconidae), a Parasite of Hemiptera-Heteroptera.**—*Proc. R. ent. Soc. Lond.* (A) **14** pt. 4–6 pp. 51–56, 5 figs., 11 refs. London, 1939.

Instances of the parasitism of Heteroptera by Braconids of the subfamily EUPHORINAE are given from the literature. In England, they have been recorded parasitising *Lygus* and also *Oncotylus viridiflavus*, Goeze, and *Poeciloscytus unifasciatus*, F., but in the case of the last two, the parasites were not reared. In June 1936, a population of the Capsid, *Calocoris norvegicus*, Gmel., parasitised to the extent of 15–20 per cent. was found in a field near Cambridge, England. Adults emerging in May 1937 were identified as *Euphorus pallipes*, Curtis. Throughout the winter of 1937–38, pupae were kept in an open shed in individual glass cylinders, closed at one end with cellophane and at the other with muslin, standing on a perforated zinc plate over damp moss and protected by matting in frosty weather. All the adults emerged between 10th and 15th May, about a week earlier than in the previous year, and when supplied with syrup, they lived for 2–3 weeks. They were sluggish and showed a pronounced tendency to climb a vertical surface. All oviposition, the process of which is described, took place after pairing. The hosts were swept from wild mustard in a field of winter oats. Nymphs in the second and third instars were usually chosen for oviposition. They sometimes moulted after being parasitised, but none attained the last nymphal instar. Owing to a scarcity of bugs of a suitable age, it was not possible to determine the maximum number of eggs laid by females, but it was not less than 12 and is probably many more. The development of the egg, which floats freely in the haemocoele of the host, is described. Immediately beneath the chorion is a peripheral layer of cells forming

the trophic membrane [*cf. R.A.E.*, A **16** 621]. When the larva hatches, these cells become more or less dissociated and float out into the haemocoele of the host, where they maintain an independent existence, and are fed upon by the developing parasite. The development of the larva is described. When ready to pupate, it gnaws through the body-wall of the host, falls to the ground and spins a cocoon just below the surface of the soil. In the laboratory, it will spin up in sand, moss or cotton wool. Development from oviposition to pupation usually lasted 34–36 days, and each of the four distinguishable larval instars appeared to last about 4 days. The total life-cycle occupies a year, more than three-quarters of which is spent in the pupal stage. The host feeds throughout the development of the parasite, and lives for 1 or 2 days after the latter has left it.

Though not more than one parasite was observed in a single host in the field, several frequently occurred under laboratory conditions, but only one survived. *E. pallipes* was itself parasitised by an Ichneumonid of the genus *Mesochorus*, which appeared occasionally in collections made in the field. The egg of the hyperparasite is apparently laid in the haemocoele of young larvae of *E. pallipes* within the abdomen of the host.

It is doubtful whether *E. pallipes* exercises much control over *C. norvegicus*, although it is widely distributed. It is exceptional to find more than 20–30 per cent. of the Capsid population parasitised, and usually the proportion is much less.

## Papers noticed by Title only.

Mitchener (A. V.). **Vegetable Insects and their Control** [in Manitoba]. —*Circ. Dep. Agric. Manitoba* no. 127 folder [16 pp.]. Winnipeg, 1939. [*Cf. R.A.E.*, A **21** 349.]

Ehrenhardt (H.). **Vergleichende Untersuchungen über postembryonale Entwicklungszustände in den Ovarien der Blutlaus.** [Comparative Investigations on Development of the Ovaries in Larvae and Nymphs of *Eriosoma lanigerum*, Hsm.]—*Anz. Schädlingsk.* **15** pt. 7 pp. 73–80, 10 figs., 14 refs. Berlin, 1939.

Hussein (M.). **An Expedition to Arabia for Locust Investigations.**—*Bull. Minist. Agric. Egypt* no. 225 22 pp., 6 maps, 4 pls. Cairo, 1939. [*See R.A.E.*, A **27** 481.]

Semans (F. M.). **Protozoan Parasites of the Orthoptera, with special Reference to those of Ohio. II. Description of the Protozoan Parasites recognized in this Study.**—*Ohio J. Sci.* **39** no. 3 pp. 157–181, 44 figs., 54 refs. Columbus, Ohio, 1939. [*Cf. R.A.E.*, A **25** 264.]

Williams (C. B.). **An Analysis of four years Captures of Insects in a Light Trap. Part I. General Survey ; Sex Proportion ; Phenology ; and Time of Flight.**—*Trans. R. ent. Soc. Lond.* **89** pt. 6 pp. 79–131, 1 pl., 9 figs. London, 1939.

Silvestri (F.). **Importanza dell'entomologia nell'economia mondiale.** [The Importance of Entomology in World Economy (a general survey).]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 1506–1522. Berlin, 1939.

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Entomologische Litteraturblätter (Berlin) : 6. Jahrg. (1906). Nos. 2 & 10.

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